

Service Manual

Personal Computer
CF-2700



Specifications

Microprocessor	Z-80A
Memory	ROM 32 K bytes (MSX-BASIC)
	Main RAM 64K bytes
	Video RAM 16K bytes
Video system	
Controller	TMS 9929A
Number of displayable characters	32 characters x 24 lines
	8 (H) x 8 (W) dots/character mode
	40 characters x 24 lines
	8 (H) x 6 (W) dots/character mode
Number of displayable dots	256 (H) x 192 (V) dots
Output signals	Video output, RF output
Sound system	
Controller	AY-3-8910A
Functions	8 octave, 3 chord output
Keyboard	73 keys
Cassette tape interface	
System	FSK
Transfer rate	1200/2400 baud
I/O ports	
Slot	2 (comforms to MSX specifications)
Printer port	1, 14-pin
General port	2, 9-pin each
Sound output	1
Dimensions and Weight (Main unit)	436 (W) x 245 (D) x 90 (H) mm
	approx. 3.6 kg
Power requirements	
Voltage	220 V, 50 Hz
	(Only for UK 240 V, 50 Hz)
Power consumption	28 W

Design and Specifications are subject to change without notice.

Panasonic

Matsushita Electric Trading Co., Ltd.
P.O. Box 288, Central Osaka Japan

CONTENTS

Location of Controls and Components	3
Memory Map	5
I/O Map	5
General for Peripheral Circuit	7
Display Screen, Character Codes	20
Self Test	21
Block Diagram	33
Disassembly Instructions	34
Adjustment	39
Connector Pin Connection	40
Wiring Connection Diagram	42
Schematic Diagram (Main Board)	43
Printed Circuit Board (Main Board)	47
Schematic Diagram & Printed Circuit Board (Power Source)	49
Schematic Diagram (Video Board)	50
Printed Circuit Board (Video Board)	51
Printed Circuit Board (Keyboard)	52
IC Block Diagram	53
Parts Location	62
Parts Location (Keyboard)	63
Packing Instruction	64
Replacement Parts List	64

Copyright Matsushita Electric Industrial Co., Ltd. 1984

The **MSX** system realizes software compatibility between **MSX** personal computers. **MSX** is a trademark of Microsoft Corporation.

IMPORTANT (FOR U.K.)

The wires in the mains lead are coloured in accordance with the following codes:
 Blue: Neutral Brown: Live
 As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings

identifying the terminals in your plug, proceed as follows:

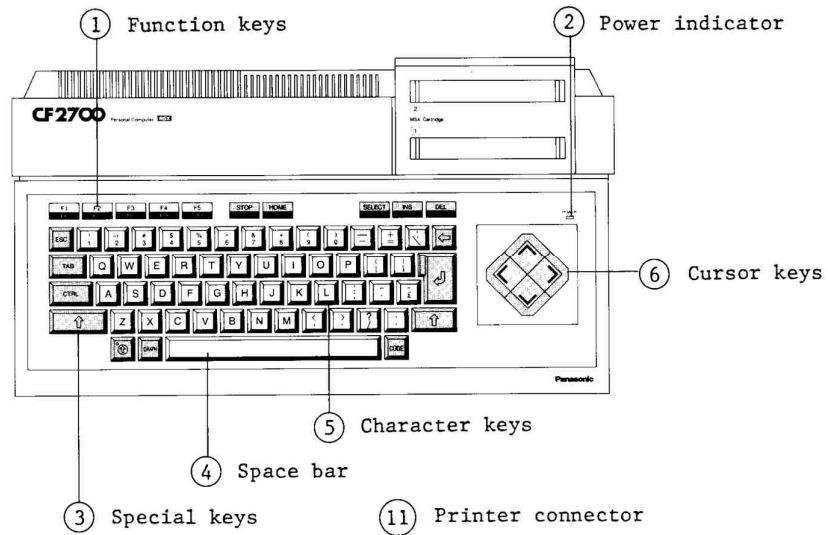
- The wire which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.
- The wire which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.

Notes:

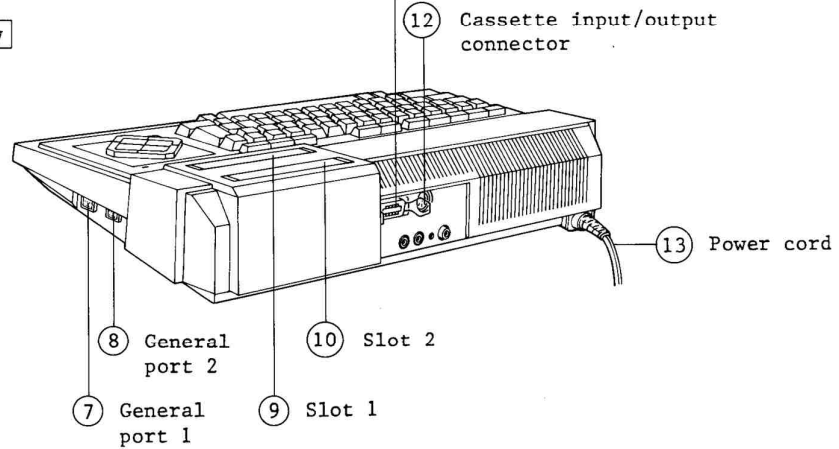
- Disconnect the mains plug from the supply socket when not in use.
- Do not remove cover. Live parts inside.

Location of Controls and Components

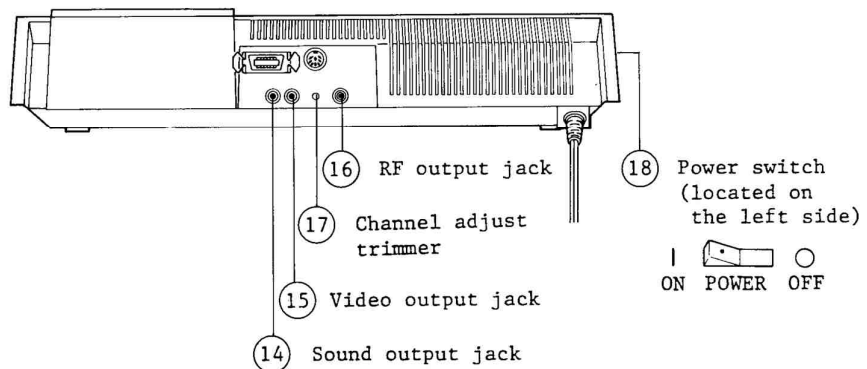
Top View



Right End Rear View

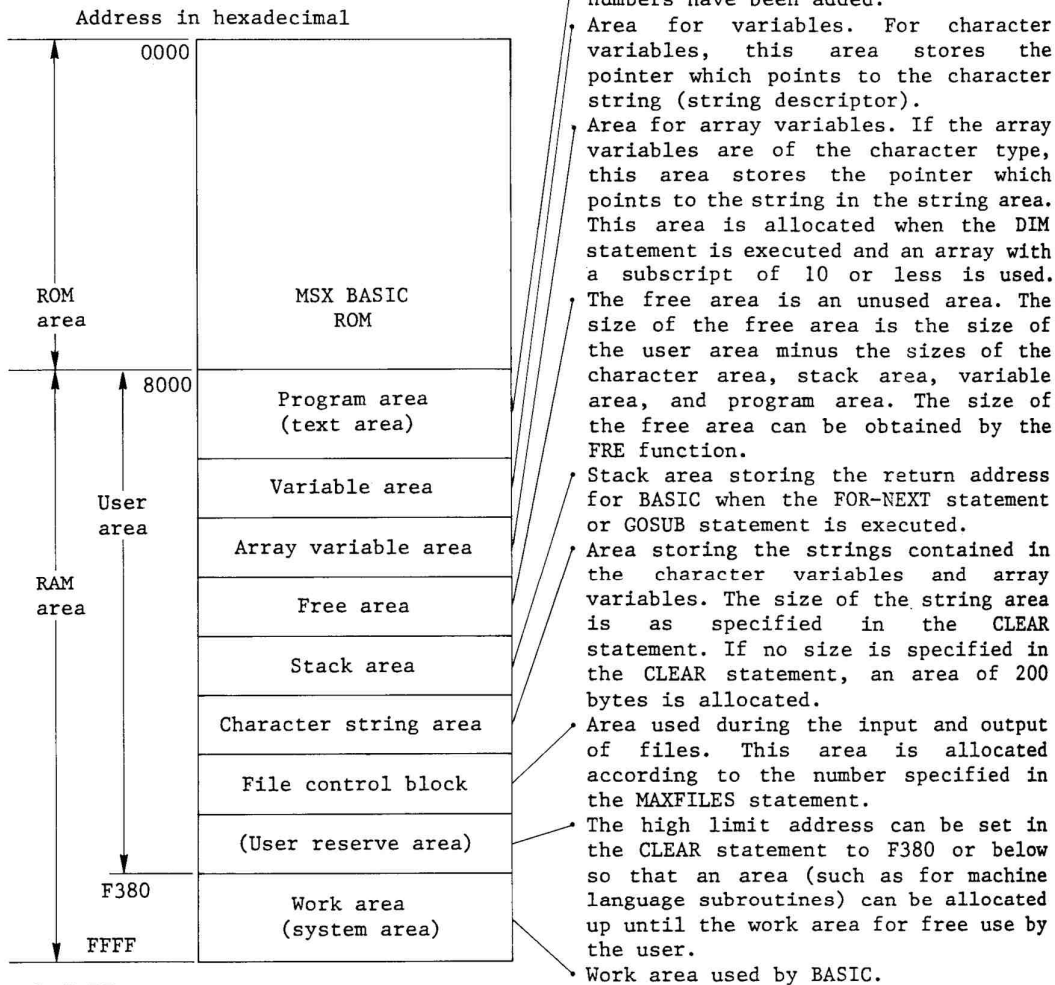


Rear View



- ① Function keys
Key used for easy inputs of pre-defined character strings.
- ② Power indicator
Lights when the power switch is turned on and goes out when the power is turned off.
- ③ Special keys
Keys used to select, correct, and edit input characters, and control program execution.
- ④ Space bar
Bar used to input a space between characters.
- ⑤ Character keys
Keys used to input characters.
- ⑥ Cursor keys
Keys used to move the cursor.
- ⑦ ⑧ General port 1, General port 2
Connectors used to connect joysticks, tablets, etc.
- ⑨ ⑩ Slot 1. Slot 2
Slots for MSX cartridges.
- ⑪ Printer connector
Connector used to connect a printer, plotter, etc.
- ⑫ Cassette Input/Output Connector
Connector used to connect a cassette tape recorder.
- ⑬ Power cord
- ⑭ Sound output jack
Audio (sound) signal output jack. Connects to the TV audio input terminal.
- ⑮ Video output jack
Video signal output jack. Connects to the TV video input terminal.
- ⑯ RF output jack
RF signal output jack. Connects to the TV antenna terminal.
- ⑰ Channel adjust trimmer
After connecting the TV and computer, turn on the power switch. Set the TV to UHF channels 35-37. Insert the adjustment screwdriver into the channel adjust trimmer and adjust for a clear picture.
- ⑱ Power switch
Power turns on when set to "ON" and the power indicator lights up. Power turns off when set to "OFF".

Memory Map (when using BASIC)



I/O Map

PPI (8255) Bit Assignment

Port	Bit	I/O	Signal Name	Description
A	0	Output	CS0L	Specifies the slot number for addresses &H0-&H3FF
	1		CS0H	
	2		CS1L	Specifies the slot number for addresses &H4000-&H7FFF
	3		CS1H	
	4		CS2L	Specifies the slot number for addresses &H8000-&H8FFF
	5		CS2H	
	6		CS3L	Specifies the slot number for addresses &HC000-&HFFFF
	7		CS3H	
B	0	Input		Keyboard return signal
	7			
C	0, 1	Output	KB0, KB1	Keyboard scan signal
	2, 3		KB2, KB3	
	4		CASON	Cassette control (ON when L)
	5		CASW	Cassette write signal
	6		CAPS	CAPS lamp signal (lights when L)
	7		SOUND	Software controlled sound output

I/O Address Assignment

I/O address (hexadecimal)	I/O address	R/W	Contents	Remarks
00		W	Data write to the video RAM	
80		R	Data read from the video RAM	
90	■RS-232C	W	Command, address set	
	Printer	R	Status read	
98		W	Address latch	
	VDP (9929A)	W	Data write	
A0		R	Data read	
A8	PSG (AY-3-8910A)	W	Port A data write	
	PP1 (8255)	R	Port A data read	
B0		W	Port B data write	
C0		R	Port B data read	
D0		W	Port C data write	
		R	Port C data read	
D8		W	Mode set	
		W	Strobe output (b0)	Latch output
		R	Status input (b1)	"1" when busy
FF		W	Print data	Latch output

- The I/O address with the ■ mark are provided to optional equipment.
- For details on the VDP, PSG, and PPI, see their respective manuals.
- Addresses &H40-&HFF represent the system reserve area.

PSG Bit Assignment

Port	Bit	I/O	Bit 6 at Port B	Connector Pin Number
A	0	Input	Low level	Port 1 pin 1
			High level	Port 2 pin 1
	1		Low level	Port 1 pin 2
			High level	Port 2 pin 2
	2		Low level	Port 1 pin 3
			High level	Port 2 pin 3
	3		Low level	Port 1 pin 4
			High level	Port 2 pin 4
B	4	Output	Low level	Port 1 pin 6
			High level	Port 2 pin 6
	5		Low level	Port 1 pin 7
			High level	Port 2 pin 7
	6		Keymatrix assignment input (low level)	
	7		CSAR (Read signal of the cassette tape)	
	0		Port 1 pin 6	} Note 2
	1		Port 1 pin 7	
	2		Port 2 pin 6	
	3		Port 2 pin 7	
	4		Port 1 pin 8	
	5		Port 2 pin 8	
	6		Input select of port A	
	7			

Note 1: Either port 1 or 2 is selected by the output level of bit 6 at port B.
Writing a "1" to bit 6 at port B → high level output → port 2 selected.
Writing a "0" to bit 6 at port B → low level output → port 1 selected.

Note 2: Be sure to output a high level at these pins if port B is to be used for input.

General for Peripheral Circuit

CPU (Central Processing Unit) Peripheral Circuit

CPU Peripheral Circuit consists of CPU, Clock Generator Circuit and Reset Circuit.

Z80A (μ PD780C-1, IC8) is used as CPU. An interruption system is maskable interrupt, not non-maskable. AND signals of VDP's $\overline{\text{INT}}$ and an external interrupt are fed to $\overline{\text{INT}}$ terminal. In M1 cycle, 1 WAIT is inserted, and external WAIT is accepted asynchronously with CLOCK signal. $\overline{\text{BUSRQ}}$ and $\overline{\text{BUSAK}}$ are not used, neither DMA function.

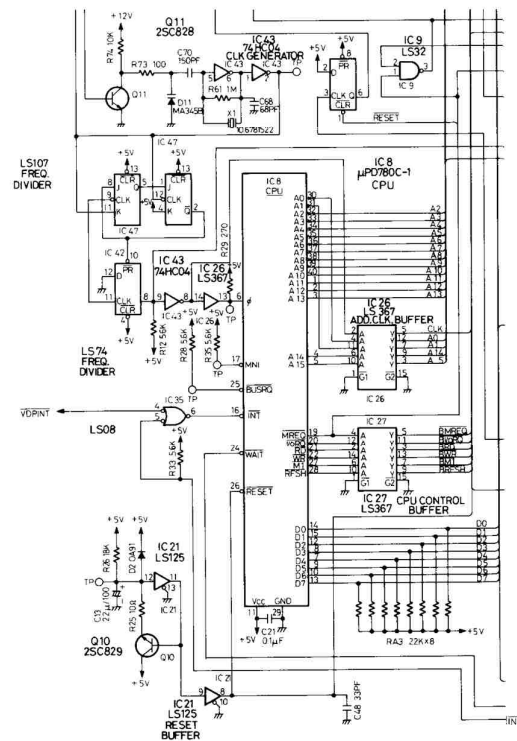


Fig. 1 CPU Peripheral Circuit

The CLOCK Generator Circuit--Serial Oscillation Circuit of 74HC04 (IC43)--oscillates 10.6781522 MHz to generate VDP CLOCK and, at the same time, generates CPU CLOCK in the circuit of 74LS74 (IC42) and 74LS107 (IC47) which divides VDP CLOCK by 3 to get 3.559384 MHz. Moreover, CLOCK Generator Circuit divides CPU CLOCK into halves to get 1.779462 MHz by 74LS74 (IC39) and generates PSG CLOCK.

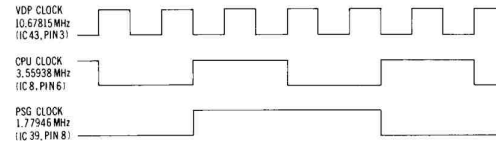


Fig. 2 CLOCK Waveform

The Reset Circuit utilizes the charge of CR Circuit (C13 and R26), but it takes too much time to raise RESET signal by only the CR. So the circuit is compulsively raised by Q10, when each end of C becomes about 1.5 V. Therefore, RESET signal changes "L" into "H" in 60 ms after power source ON.

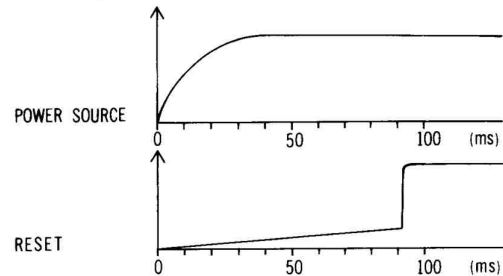


Fig. 3 RESET Signal

ROM

This system uses 32 K x 8 bits MASK ROM (IC32, MN23257) which builds in the MSX BASIC. $\overline{\text{CS}}$ is connected to SLT0, and $\overline{\text{OE}}$ to A15. Access time is available up to 325 ns.

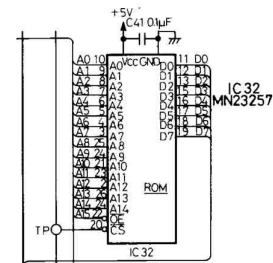


Fig. 4 ROM Peripheral

Main Memory Peripheral Circuit

Main Memory Peripheral Circuit consists of Main Memory and Memory Access Circuit.

The Main Memory has a 64 KB memory space by using eight 16 K x 8-bit DRAMs. Refresh is performed by RAS-ONLY REFRESH. Because RAS pre-charge time in refreshing M1 cycle is ensured to be 100 ns by Timing Chart, the access time of RAM must be 150 ns. In the Memory Access Circuit, RAS is generated by MERQ or RESH and CLOCK. The switchover of the row address to the column address is

done by the multiplexer 74LS157 and CAS is generated by being staggered the time, with the condenser C35, when the column address is outputted. C35 ensures that the CAS will be "L", considering differences of the output timing of 74LS157, after the switchover of the row address to the column address. WE is generated by BWR, and OE by BRD. RAS, CAS, WE and OE protect from the undershoot by being inserted a resistance for the damping.

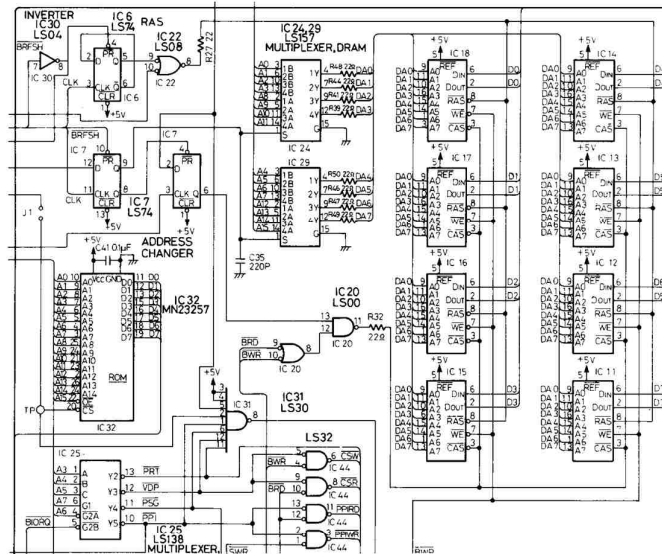


Fig. 5 I/O Select Peripheral Circuit

I/O Select Peripheral Circuit

All of Input/Output with external equipment are done through I/O ports in this system, and an access signal of each port is generated in this circuit. I/O Select Peripheral Circuit consists of I/O Select Generator Circuit, Chip Access Signal Generator Circuit and Short Write Generating Circuit.

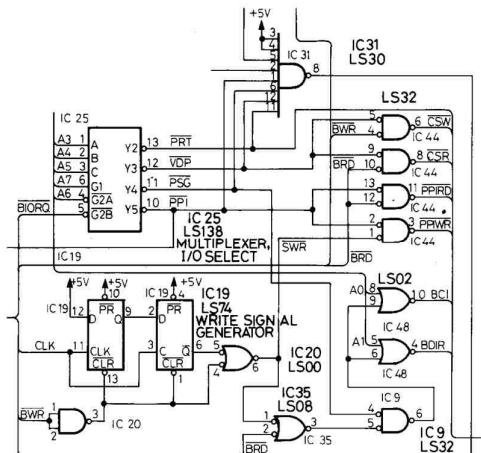


Fig. 6 I/O Select Peripheral Circuit

I/O Select Generator Circuit generates I/O Select signal according to the I/O map. This signal is generated through high-order five bits in low-order byte of Address Bus and through $\overline{\text{BIORQ}}$ and Multiplexer 74LS138 (IC25). In order to ensure data stabilizing time when PSG is engaged in WRITE, and to be considered

that the output delay time is 350 ns when PPI is in WRITE, WRITE signal is raised faster by Short Write Generator Circuit.

Chip Access Generator Circuit generates $\overline{\text{CSW/CSR}}$ (VDP Access signals), $\overline{\text{PPIWR/PPIRD}}$ (PPI Access signals) and $\overline{\text{BCI/BDIR}}$ (PSG Access signals) from I/O Select signal and BWR/BRD/SWR.

VDP (Video Display Processor) Peripheral Circuit

This system uses TI's TMS9929A as CRTIC. This LSI's features are as follows.

- . 256 x 192 pixels resolution
- . Used 4,8 and 16 KB as VRAM (16 KB is used in MSX.)

- . Automatic refreshing function of VRAM
- . Composite video output, in PAL system
- . Interruptible in every frame
- . Automatic processing of the sprite screen.

	Resolution	Pattern Size	Patterns	Colours	Sprite	Screen
Graphic I (SCREEN 1)	192x256 pixels	8x8 pixels	256 patterns	16 colours	usable	24rows x 32columns (768)
Graphic II (SCREEN 2)	192x256 pixels	8x8 pixels	768 patterns	16 colours	usable	24rows x 32columns (768)
Multicolour (SCREEN 3)	48x64 blocks	pixels	—	16 colours	usable	24rows x 32columns (768)
Text (SCREEN 0)	192x256 pixels	8x6 pixels	256 patterns	2 out of 16 colours	unusable	24rows x 40columns (960)

Table 1 Screen Mode of VDP.

A VDP's operation depends on values of 9 registers in VDP and a table on VRAM. VDP has three control signals which are $\overline{\text{CSW}}$, $\overline{\text{CSR}}$ and $\overline{\text{MODE}}$. $\overline{\text{MODE}}$ signal distinguishes which should be a candidate for

READ and WRITE, VDP resistor or VRAM. In "L", VRAM is the candidate. $\overline{\text{CSR}}$ is generated by Inverted NAND of $\overline{\text{CSVDP}}$ and $\overline{\text{RD}}$, and $\overline{\text{CSW}}$ is by OR of $\overline{\text{CSVDP}}$ and $\overline{\text{WR}}$.

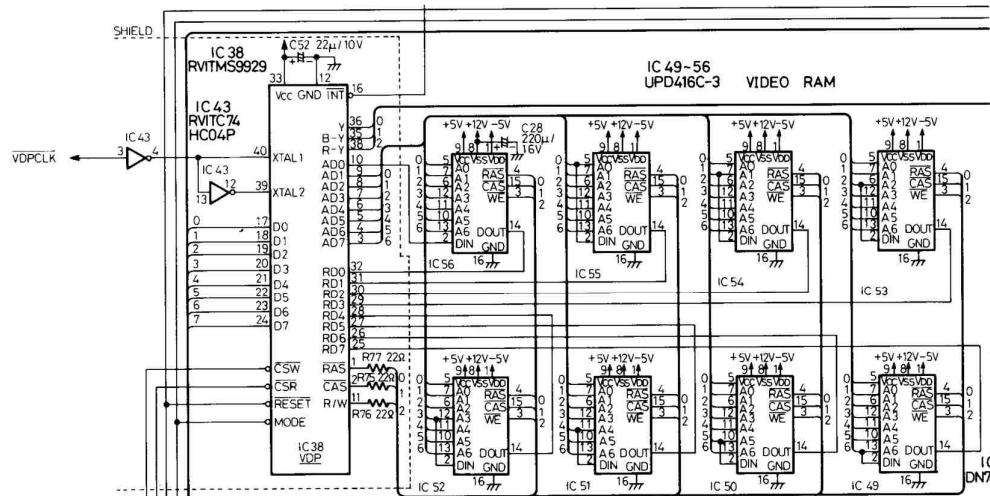


Fig. 7 VDP Peripheral Circuit Diagram

PSG (Programmable Sound Generator) Peripheral Circuit
--

PSG Block consists of PSG and General Port Circuit. This system uses GI's AY-3-8910A as PSG, which makes it enable to produce 8 octaves, triple chords and noise-sound effects. This LSI builds in a tone generator, a noise generator, an envelope generator and 16 registers whose each value decides the frequency

and the volume of the sound by software. This LSI has also two I/O ports which are available for Input/Output with General Port, Keyboard Control and input to a cassette tape recorder. In this occasion, each bit in port A/B is assigned as the following table.

Signal	I/O	Function
IO A0	Input	PORT 1-1 PORT 2-1
IO A1		PORT 1-2 PORT 2-2
IO A2		PORT 1-3 PORT 2-3
IO A3		PORT 1-4 PORT 2-4
IO A4		PORT 1-6 PORT 2-6
IO A5		PORT 1-7 PORT 2-7
IO A6		Input specifying the layout of Keyboard
IO A7		Read signal input from a cassette tape recorder
IO B0	Output	PORT1
IO B1		PORT1
IO B2		PORT2
IO B3		PORT2
IO B4		PORT1
IO B5		PORT2
IO B6		Selecting input of PORT A "L"=PORT 1 "H"=PORT 2
IO B7		_____

Table 2 Bit-Assignment in PSG Port

PSG has three control lines--BDIR, BC1 and BC2--, whose control signals in

Input/Output are shown as the following table.

BDIR	BC1	BC2	State
0	0	1	Not Selected
0	1	1	Readout from PSG
1	0	1	Writing in PSG
1	1	1	Address latch

Table 3 PSG Control Signal

In General Port Circuit, there are two general ports (Input 4-bit, Output 1-bit and I/O 2-bit) using multiplexer 74LS157

(IC28, 33) and open collector gate 74LS09 (IC37, 40).

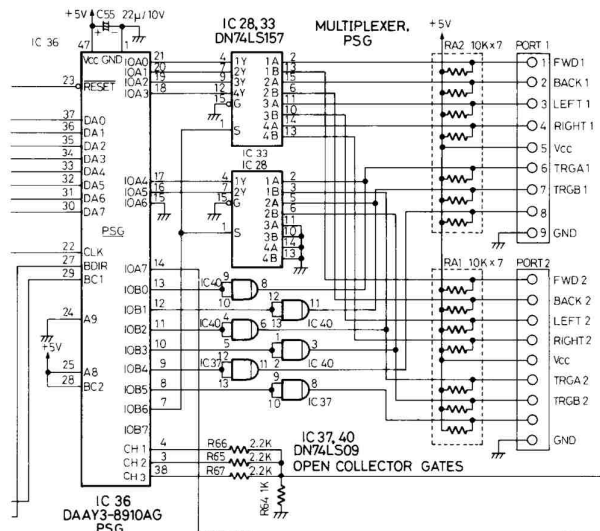


Fig. 8 PSG Peripheral Circuit

CF-2700 uses AY-3-8910A whose maximum access time is 200ns and minimum width of write data pulse is 165ns.

PPI (Programmable Peripheral Interface) Peripheral Circuit

PPI Block consists of PPI (using μ PD8255AC-5), Keyboard Control Circuit and Slot Signal Generator Circuit. CF-2700 adopts MODE 0 (ports A,C for output, and port B for input). This LSI is utilized for specifying the slot num-

ber, controlling Keyboard, for output to a cassette tape recorder and its control and output of click sound. Bits of three ports are assigned as the following table.

Port	I/O	Bit	Function
A	Output	0~7	Specifying the Slot Number
B	Input	0~7	Keyboard Return Signal
C	Output	0~3	Keyboard Scan Signal
		4	Controlling the motor of a cassette tape recorder 0=ON 1=OFF
		5	Signal writing in a cassette tape recorder
		6	Controlling Keyboard CAPS Lamp 0=LIGHTING
		7	Output of Click Sound

Table 4 Port function in PPI

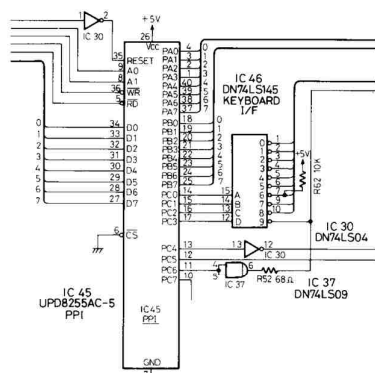


Fig. 9 PPI Peripheral Circuit

Port A is used for specifying the slot number of address bank in units of 16 KB. Port A is preset for this operation as the following table.

Bit of Port A	Contents
PA1 PA0	Slot Number of Page 0
PA3 PA2	Slot Number of Page 1
PA5 PA4	Slot Number of Page 2
PA7 PA6	Slot Number of Page 3

Table 5 Meaning of each bit in Port A

Keyboard Scan signals (0-3 bits) of Port C are decoded by 74LS145 (IC46) and inputted to Port B through Keyboard.

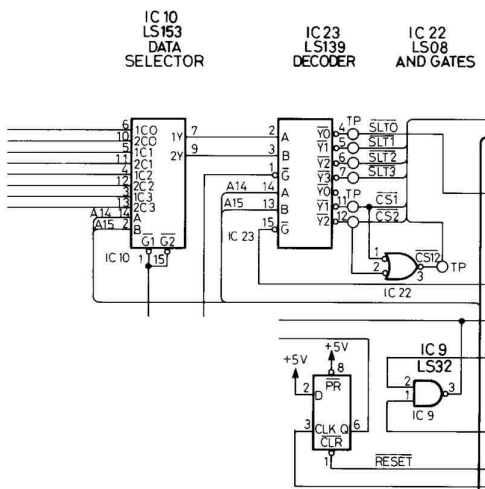


Fig. 10 Slot Signal Generator Circuit

Slot signal is generated from a signal which is set up in Port A by data selector 74LS153 (IC10) and decoder 74LS139 (IC23).

Cartridge

Signals connected to Cartridge Slot are described in the table 6 and explained in the table 7.

Data bus is connected via Buffer 74LS245 (IC5). When I/O or Slot 0 is selected, the mainframe and the slot are separated and the bus is controlled to go to the mainframe in READ and INTERRUPT operations.

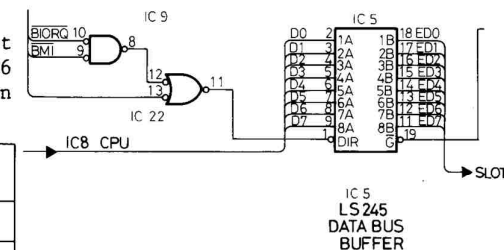


Fig. 11 Data Bus/Buffer Circuit

$\overline{CS1}$, $\overline{CS2}$ and $\overline{CS12}$ are generated from A15 and A14 by decoder 74LS139. (IC23).

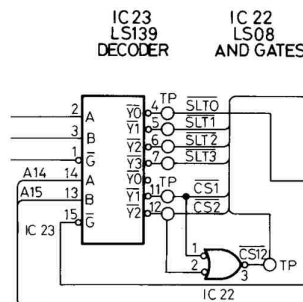


Fig. 12 Chip Select Generator Circuit

Pin Number	Name	I/O Note 1	Pin Number	Name	I/O Note 1
1	CS1	0	2	CS2	0
3	CS12	0	4	SLTSL	0
5	RESERVED	-	6	RFSH	0
7	WAIT	I	8	INT	I
9	MI	0	10	BUSDIR	I
11	TORQ	0	12	MERQ	0
13	WR	0	14	RD	0
15	RESET	0	16	RESERVED	-
17	A9	0	18	A15	0
19	A11	0	20	A10	0
21	A7	0	22	A6	0
23	A12	0	24	A8	0
25	A14	0	26	A13	0
27	A1	0	28	A0	0
29	A3	0	30	A2	0
31	A5	0	32	A4	0
33	D1	I/O	34	D0	I/O
35	D3	I/O	36	D2	I/O
37	D5	I/O	38	D4	I/O
39	D7	I/O	40	D6	I/O
41	GND	-	42	CLOCK	0
43	GND	-	44	SW1	-
45	+5 V	-	46	SW2	-
47	+5 V	-	48	+12 V	-
49	SUNDIN	I	50	-12 V	-

- a) Note 1: The distinction of Input/Output is based on the mainframe.
b) Reserved terminals are forbidden using.

Table 6 Connected Signal Lines of
Cartridge Bus

Pin No.	Name	Contents
1	CS1	ROM 4000...7FFF Address Select Signal
2	CS2	ROM 8000...BFFF Address Select Signal
3	CS12	ROM 4000...BFFF Address Select Signal (256 K for ROM)
4	SLTSL	Slot Select Signal adds Select Signal peculiar to each slot
5	RESERVED	For Future use
6	RFSH	Refresh Cycle Signal
7	WAIT	WAIT Request Signal to CPU
8	INT	INTERRUPT Request Signal to CPU
9	M1	CPU Fetch Cycle Signal
10	BUSDIR	Control Signal for direction of external Data Bus Select a cartridge and outputs L level from each cartridge except Memory at the same time when the data are outputted.
11	IORQ	I/O Request Signal
12	MERQ	Memory Request Signal
13	WR	Write Timing Signal
14	RD	Read Timing Signal
15	RESET	System Reset Signal
16	RESERVED	For future use
17~32	A0~A15	Address Bus Signal
33~40	D0~D7	Data Bus Signal
41	GND	Ground
42	CLOCK	CPU Clock 3.559 MHz
43	GND	Ground
44,46	SW1, SW2	For protect in Connect/Disconnet
45,47	+5 V	Power Source +5 V
48	+12 V	Power Source +12 V
49	SUNDIN	Sound Input Signal (-5 dbm)
50	-12 V	Power Source -12 V

Table 7 Explanation of Signal Lines

Cassette Interface Circuit

MSX uses FSK method for recording, whose transfer rate supports 1200 baud and

2400 baud and the transfer waveform is shown in the table 8.

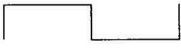
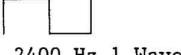
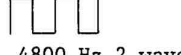
	0	1
1200 baud	 1200 Hz 1 Wave	 2400 Hz 2 Waves
2400 baud	 2400 Hz 1 Wave	 4800 Hz 2 waves

Table 8 Data Waveform

Therefore, Interface Circuit must ensure 1200 Hz-4800 Hz transfer.

(i) Input Circuit

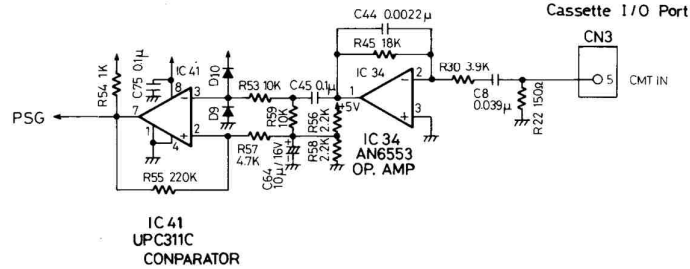


Fig. 13 Cassette Input Circuit

Input terminal is terminated by the 150 Ω resistance whose value is set for adjusting to the amplifier's characteristic on the cassette. This circuit has the gain by using OP-Amp. and also the characteristic as the filter, the waveform characteristic at this time is as follows.

This circuit uses a high-speed comparator to ensure the reproducing of 4800 Hz waveform. The standard voltage supplied to the comparator is set to about 2.5 V by resistance-division. This voltage is used in the bias voltage at the $\ominus$ terminal. R54 and R55 let the circuit have the hysteresis characteristic and increase the noise margin.

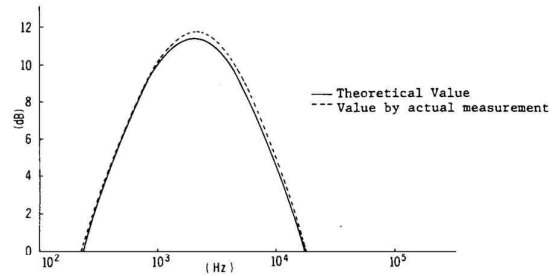


Fig. 14 Waveform Characteristic in Cassette Input Circuit

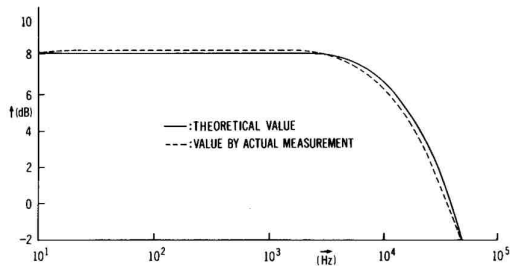


Fig. 20 Frequency Characteristic for PSG Output

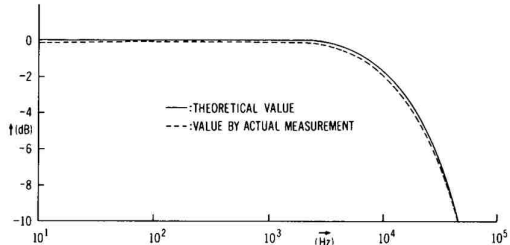


Fig. 21 Frequency Characteristic for Sound Input Signal

Power Supply Circuit

This circuit using the DROPPER system is to supply four kinds power of +5 V, -5V, +12 V and -12 V.

In a primary circuit, there is a line filter composed of condensers and coils that is to prevent a malfunction due to external noises and reduce useless radiation outward.

In a voltage-regulator circuit of a secondary circuit, +5 V circuit consists of discrete elements and +12 V, -5 V, -12 V circuits are composed of general constant-voltage regulator ICs.

(1) Operation of +5 V Voltage-Regulator Circuit

A voltage that is rectified in full wave by diodes (D7, D8) and flattened by electrolytic capacitor (C7) is applied into a emitter (transistor Q1). The base current of the transistor Q1 is governed by a transistor Q7. The stabilization of the output voltage is achieved by varying the base current of the transistor Q1 that is to change V_{CE} of Q1.

This circuit produces a required reference voltage by dividing +12 V constant-voltage output with resistances R5, VR1 and R80, that is, enables to vary an output voltage by adjusting a value of VR1 (voltage-dividing ratio).

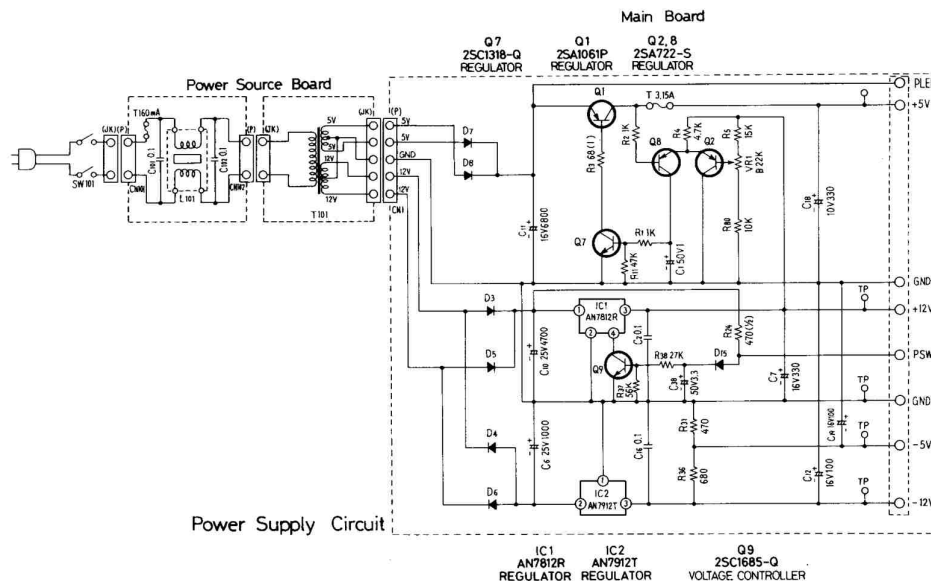
The detection of errors between the reference and output voltages is made in a differential amplification circuit of transistors Q8 and Q2. This control method is as the following.

- ① +5 V output voltage ascends.
- ↓
- ② Base current of the transistor Q8 decreases.
- ↓
- ③ Current flowing into the resistance R1 decreases.
- ↓
- ④ Base current of the transistor Q7 decreases.
- ↓
- ⑤ Base current of the transistor Q1 decreases.
- ↓
- ⑥ V_{CE} of the transistor Q1 increase.
- ↓
- ⑦ Output voltage descends.

When the output voltage descends, the contrary phenomena to the above happens--the V_{CE} of the transistor Q1 decreases and the output voltage increases.

(2) Operation of +12 V Voltage-Regulator Circuit

A voltage that is rectified in full wave by diodes (D3, D5) and flattened by an electrolytic capacitor C10 is inputted into an input terminal of a regulator IC (IC1). This IC1, which is for the constant-voltage power supply, outputs stabilized +12 V into an output terminal. Moreover, this IC can control the output with an external signal, but we will describe it in details later.



(3) Operation of -12 V Voltage-Regulator Circuit

A voltage that is rectified in full wave by diodes (D4, D6) and flattened by an electrolytic capacitor C6 is inputted into an input terminal of a regulator IC (IC2). This IC2, which is for the constant-voltage power, outputs stabilized -12 V into an output terminal.

(4) Control of Output Voltage with External Signal

The PSW terminal can control the output of +5 V and +12 V. When the PSW terminal is connected with GND, each voltage is outputted normally, and when it is open each voltage becomes about 0 V. (-12 V and -5 V are left as it is.)

This control is made by transistor Q9 and IC1. Pin No. 4 in IC1 is a terminal of which output voltage becomes about 0 V when current more than about 500 μ A flows. If controlled this pin externally, it enables to control +12 V output voltage. The +5 V output is to be 0 V with +12 V being 0 V, because its reference voltage is made by dividing +12 V, as described in (1).

The output voltage control by the Pin No. 4 in IC1 is as the following.

- ① PSW terminal is connected with GND.
- ② Transistor Q9 is cut off.
- ③ Current of Pin No. 4 in IC1 is near about 0 V.
- ④ Output voltage of IC1 is +12 V.

SW terminal in open:

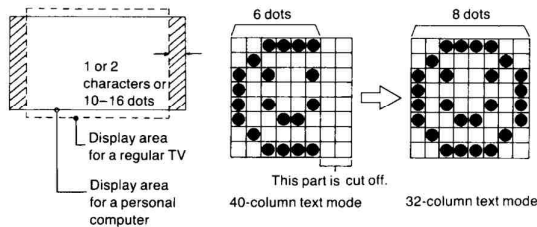
- ① PSW terminal is opened.
- ② Transistor Q9 is on.
- ③ Current of Pin No. 4 in IC1 flows.
- ④ Output voltage of IC1 is about 0 V.

R38 and C38 compose of a time constant circuit that delays rising +5 V and +12 V. R37 is a resistance for an electric discharge of C38.

Display Screen

Note the following points for an easy to see screen.

- Depending on the type of TV, the left and right edges may not be displayed on the TV screen. This may result because the display area of the TV and that of the personal computer are different. If this is the case, do not use the shaded part shown in the illustration. In the text mode, set the displayed columns using the WIDTH command to 28-29 (see the "MSX-BASIC manual"). (It is preset to 37 columns when the power is turned on.) In the graphic mode, do not use the 10-16 dots on the left and right sides when writing a program.



- Do not adjust the screen any brighter than necessary.
- Exercise care in combining colors when programming. The screen may be hard to read due to blurred colors depending on the combination of the foreground color (color of characters, etc.) and the background color. White on blue (Color 15, 5) is a relatively easy to distinguish combination. (Color 25, 4, 4 is set when the power is turned on.)
- The color and volume settings on the TV for personal computer use are slightly different from that for TV broadcast reception. Adjust accordingly when switching from a TV broadcast to the personal computer.

Note 1: Character patterns are displayed as 8H x 6W dots/character in the 40-column text display mode (SCREEN 0). (8H x 8W dots/character in the 32-column text display mode.) For this reason, the right side of some graphic symbols may be cut off when displayed. (Letters and numbers are always displayed as full characters.)

Character Codes

		High-order 4 bits (hexadecimal)																Graphic characters	
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	4	5
Low-order 4 bits (hexadecimal)	0					0	@	P	p	Ç	É	À	Á					0	Blank (NULL)
	1			!	"	1	A	Q	a	q	ü	æ	i	ä				1	☺
	2			"	"	2	B	R	b	r	é	Æ	ó	í				2	☹
	3			#	3	C	S	c	s	â	ô	û	ï					3	♥
	4			\$	4	D	T	d	t	ä	ö	ñ	Ö					4	♦
	5			%	5	E	U	e	u	à	ô	Ñ	ö					5	♠
	6			&	6	F	V	f	v	á	ú	a	Ü					6	♣
	7				7	G	W	g	w	ç	ü	o	ü					7	•
	8			(	8	H	X	h	x	ê	ý	¿	¡					8	•
	9			)	9	I	Y	i	y	ë	Ö	í	j					9	○
	A			.	A	J	Z	j	z	è	Ü	¼	ω					A	◐
	B			+	B	K	I	k	í	ê	½	~	δ					B	◑
	C			,	C	L	\	l	í	£	¼	◇	∞					C	◒
	D			-	D	=	M	]	m	}	í	¥	í	‰				D	◓
	E			.	E	>	N	^	n	ˆ	Á	Pt	«	¶				E	◔
	F			/	F	?	O	_	o	À	f	»	\$					F	◕

Examples: The character code for A is &H41=16x4+1=65 (Decimal)

Input and output of Graphic Symbols

Graphic symbols are input and output by adding a graphic header (&H01).

For example, to input and output "☺" the graphic header is used as follows. Input from the keyboard: Two bytes, &H01 and &H4A, are input.

Output to the TV or printer: Two bytes, &H01 and &H4A, are output.

Example: To output to a TV:

```
PRINT CHR$(1);CHR$(&H4A);
```

Reference: Correspondence between decimal and hexadecimal numbers.

Decimal	0~9	10	11	12	13	14	15	16	17	18	...	31	32	33	...	63	64	...	255
Hexadecimal	0~9	A	B	C	D	E	F	10	11	12	...	1F	20	21	...	3F	40	...	FF

In other words, X_2X_1 (hexadecimal)
 $=X_2 \times 16 + X_1$ (decimal).

Examples: &H1F=1x16+15=31 (decimal)
 &HFF=15x16+15=255 (decimal)

Self Test

1. Outline of Self Test

This Self Test Program is prepared for the purpose of testing hardware functions of Personal Computer CF-2700. This program is to start at the 8000H address and materials in 16 KB ROM is supplied through the slot.

2. Self Test Program

This program is made up of two main CHECK parts.

- 1) The first CHECK part -- for basic checks.
 - (1) Check the diagnostic program on. Make sure that this program is started correctly.
 - (2) VDP/VRAM basic check
Check if the interrupt flag is correctly set or reset (between CPU - VPD), and the Read/Write of VRAM (CPU - VDP - VRAM) is done correctly.
 - (3) Printer basic check
Check if the printer is connected properly and can print out checked results.
 - (4) RAM check
Check if data are correctly written in a specified address.

- (5) PSG check
Check if the Read/Write of PSG register (CPU - PSG) and the data input/output of I/O port (PSG - PSG) are made correctly.
- (6) Key input check
Check if the key input works correctly.

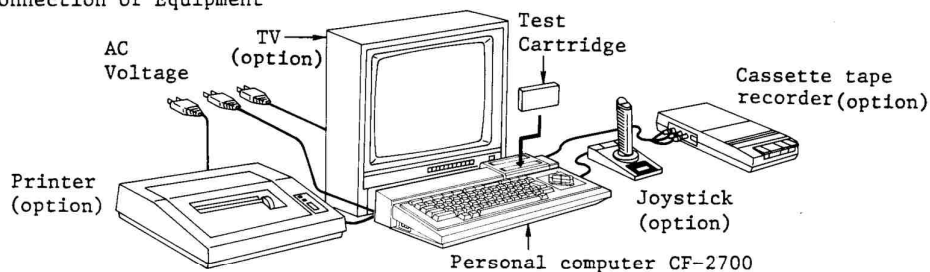
- 2) The second CHECK part -- for checks including external peripheral equipment.
 - (7) ROM check
Check if the interpreter operates correctly.
 - (8) Screen display check
Check if the screen displays correctly.
 - (9) Cassette I/O check
Check if signals are inputted/outputted correctly.
 - (10) Joystick input check
Check if the joystick sends its signals correctly by operating it.
 - (11) Print out check
Check if the printer is sent the correct print out data.
 - (12) Audio output check
Check if the audio sound is outputted properly.

3. Self Test Procedure

1) Equipment required

- | | |
|--|--------|
| (1) Test Personal Computer,
Model No.: CF-2700..... | 1 unit |
| (2) Printer or Plotter
(designed for MSX)..... | 1 unit |
| (3) Joystick
Model No.: CF-2201..... | 1 unit |
| (4) TV..... | 1 unit |
| (5) Test Cartridge
Part No.: DFWV95C0001..... | 1 pc. |
| (6) Cassette Tape Recorder..... | 1 unit |
| (7) Cassette Tape..... | 1 pc. |

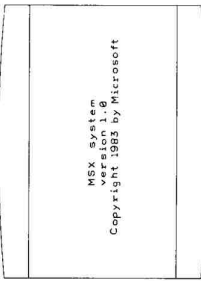
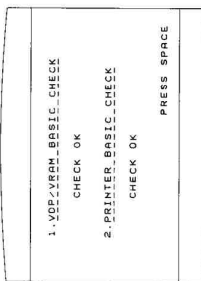
2) Connection of Equipment

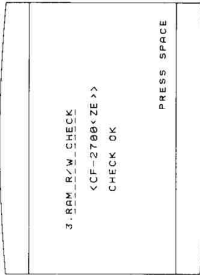
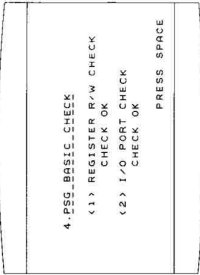
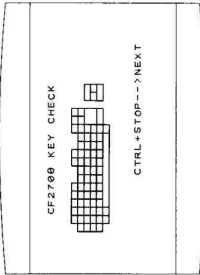


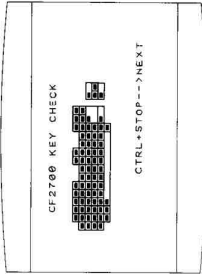
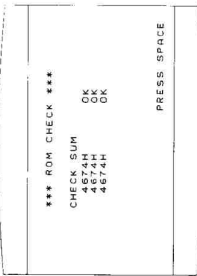
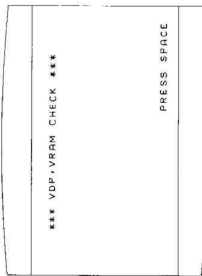
3) Preparation

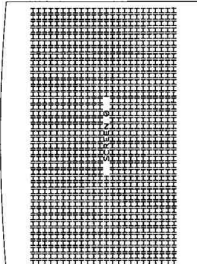
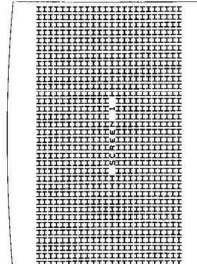
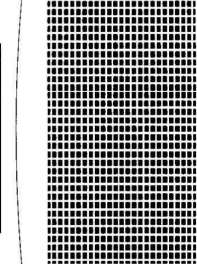
- (1) Connection should be made as shown above.
- (2) Feed the paper into the printer.
- (3) Use a printer designed for MSX. Any printers and plotters can be whichever conform to the Centronics specifications. However, printers not designed for MSX can not print the MSX characters and symbols.
- (4) Insert the Test ROM cartridge (facing a label side to you) into the slot.
- (5) Keep the cassette tape recorder away from the TV (at least 30 cm).
Since regular cassette tape recorders are for audio use, some are not suitable for the Self Test due to different audio characteristics.

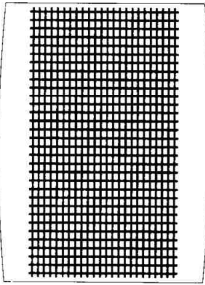
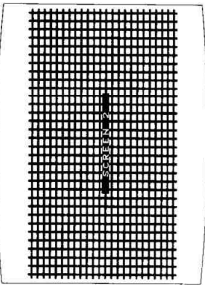
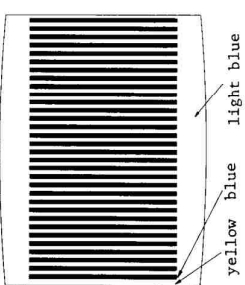
(4) Testing Procedure

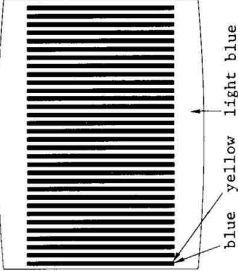
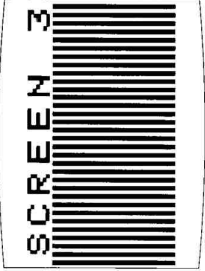
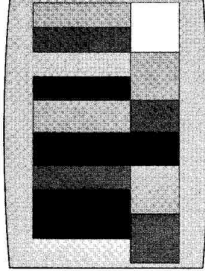
Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
1	Check the diagnostic program on. Turn on the Computer, TV and Printer. Note: When turning the computer on/off, perform it after turning the printer off. (If the computer is turned on/off when the printer on, the printer may operate improperly.)	<u>CRT Screen Displays:</u>  <u>CRT Screen Displays:</u>  <u>Printer prints out:</u> <pre> ** ** ** ** ** ** ** ** ** ** ** ** </pre>	If the condition of the TV, Printer and Computer is the same as follows, it is OK. 1. The LED of CAPS (Ⓢ) key on the keyboard and the power indicator are lit. 2. "Self Test" is displayed in the screen. 3. "SELFTEST START" is printed out. 4. The note "1a" beeps.	Note: Pressing CTRL and END key at the same time instead of SPACE key, a testing step returns to the Step 1 displayed "Self Test", even the testing step proceeds forward. <Important test points> CPU, BUS LINE, ROM, PPI, SLOT PORTION (RAM)
2	VDP/VRAM basic check Printer basic check Depress SPACE Key.	<u>CRT Screen Displays:</u> 	If displayed as the left, it is OK. If your printer outputs "VDP/VRAM BASIC CHECK NG", it is NG.	The beep sound and the LED go off. <Important test points> Check on Interrupt flag of VDP VDP, CPU - VDP Check on Read/Write of VRAM VRAM, BUS line CPU - VDP - VRAM Basic check on Printer Printer circuit, terminals cables, and printer

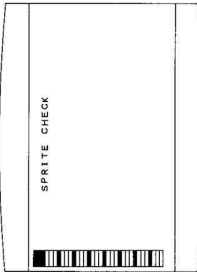
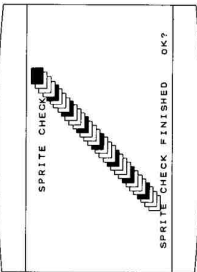
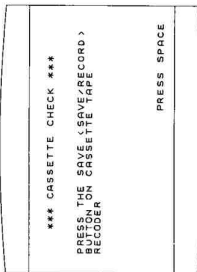
Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
		<u>Printer prints out:</u> PRINTER BASIC CHECK CHECK OK UDP/URAM BASIC CHECK CHECK OK	If your printing output matches shown left, it is OK. If displayed "PRINTER BASIC CHECK NG", it is NG. Beeps sound according to the order of the musical scale (do, re, mi, -- do) once and the LED of CAPS (Ⓢ) key also blinks during beeping. The beep sound and the LED go off.	
3	<u>RAM Check</u> Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u> 	If displayed as the left, it is OK. If "CHECK NG" is displayed, it is NG.	<Important test points> Check on Read/Write of RAM RAM, BUS line CPU - RAM
4	<u>PSG Check</u> Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u> 	If displayed as the left, it is OK. If "CHECK NG" is displayed, it is NG.	<Important test points> Check on Read/Write of PSG Register. PSG, BUS line CPU - PSG BUS line PSG - Port
5	<u>Key input check</u> Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u> 		<Important test points> PPI, Keyboard, BUS line CPU - PPI - Keyboard

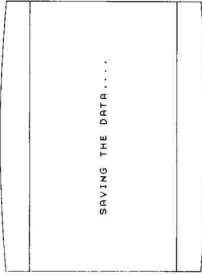
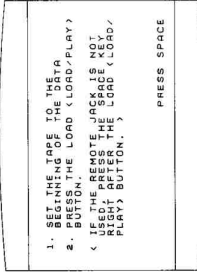
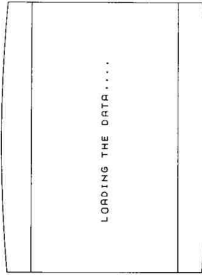
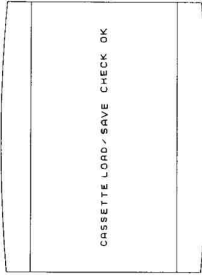
Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
6	Depress each key for key check.	<u>CRT Screen Displays:</u> 	It is OK if the mark "■" or "■" appears in the same key in the screen as that you depressed in the keyboard. Each time depressing a same key, "■" and "■" are marked by turns.	
7	<u>ROM Check</u> Depress <u>CTRL</u> key and <u>STOP</u> key at the same time.	<u>CRT Screen Displays:</u> 	If displayed as the left, it is OK. If not, it is NG.	<Important test points> Find the sum of ROM ROM
8	<u>Screen display check</u> Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u> 		

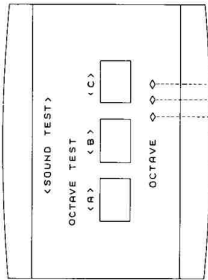
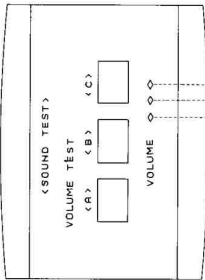
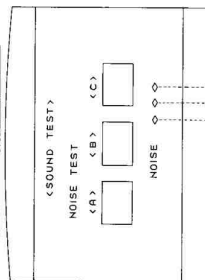
Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
9	Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u>  (Foreground: White, Background: Blue, Periphery: Light Blue)	If displayed as the left, it is OK. ("H"s 40 by 24 appear and "SCREEN 0" in the center of the screen.) If not, it is NG.	<Important test points> [Check on TEXT mode] VDP, VRAM, VRAM - CRT, CRT
10	Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u>  (Foreground: White, Background: Blue, Periphery: Light Blue)	If displayed as the left, it is OK. ("H"s 32 by 24 appear and "SCREEN 1" in the center of the screen.) If not, it is NG.	[Check on Graphic mode]
11	Depress <u>SPACE</u> Key.	<u>CRT Screen Displays:</u>  (Foreground: White, Background: Black, Periphery: Light Blue)	If "H"s 32 by 24 are displayed, it is OK.	[Check on Graphic mode]

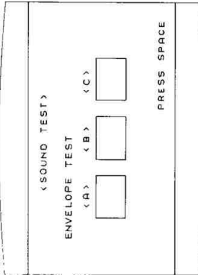
Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
		CRT Screen Displays:  (Foreground: Black, Background: White, Periphery: Light Blue)	It is OK if the screen display in the above turns over and "I"s 32 by 24 are displayed.	
		CRT Screen Displays:  (Foreground: Black, Background: White, Periphery: Light Blue)	Screen 2 appears in the center of the screen, it is OK. If not, it is NG.	
	Depress SPACE Key.	CRT Screen Displays:  yellow blue light blue	If "I"s 32 by 24 are displayed, it is OK.	
12				Check on the Multi-colour mode

Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
		CRT Screen Displays: 	It is OK if the screen display in the above turns over and "3"s 32 by 24 are displayed.	
		CRT Screen Displays: 	If matched to the left, it is OK. If not, it is NG.	
13	Depress SPACE Key.	CRT Screen Displays: 	If matched to the left, it is OK. If not, it is NG.	Colour check

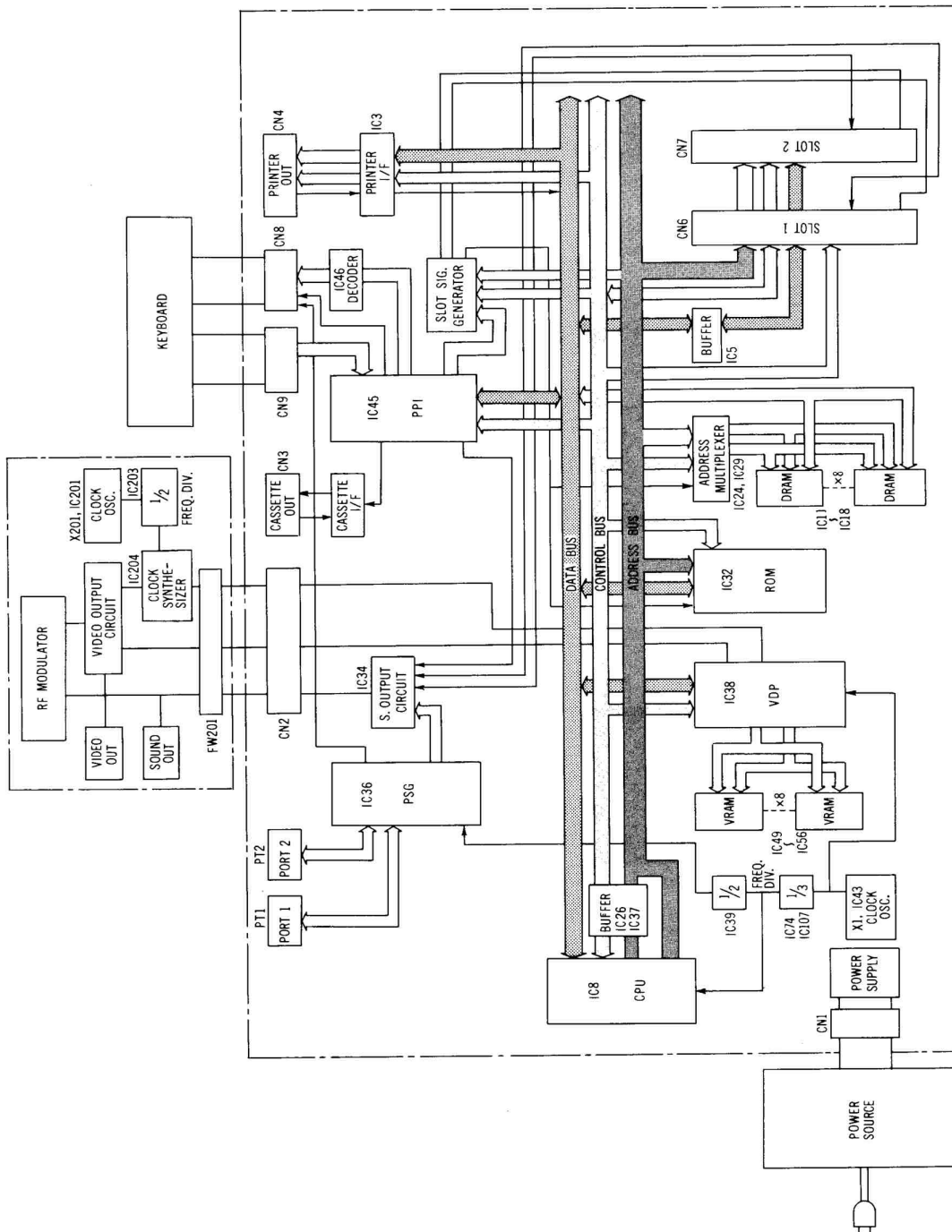
Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
14	Depress SPACE Key.	CRT Screen Displays:  a pair of black, red, white, and green light blue CRT Screen Displays: 	The overlapped 32 sprites are displayed. If, then, each sprite is moved one by one as shown in the left, it is OK.	Sprite check
15	Cassette I/O check Depress SPACE Key.	CRT Screen Displays: 	If matched to the left, it is OK. If not, it is NG.	<Important test points> PSG, BUS line CPU-PSG PPI, BUS line CPU-PPI BUS line PPI-Cassette-PSG

Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
16	After depressing the save (Save/Record) button of the cassette tape recorder, depress the [SPACE] Key.	<u>CRT Screen Displays:</u>  SAVING THE DATA.... <u>CRT Screen Displays:</u>  1. SET THE TAPE TO THE BEGINNING OF THE DATA 2. PRESS THE LOAD (LOAD/PLAY) 3. IF THE REMOTE JACK IS NOT USED, PRESS THE SPACE (LOAD/PLAY) BUTTON.) PRESS SPACE	If matched to the left, it is OK. If not, it is NG.	
17	Set the tape to the beginning of the data.			
18	After depressing the load (Load/Play) button, depress the [SPACE] key.	<u>CRT Screen Displays:</u>  LOADING THE DATA.... <u>CRT Screen Displays:</u>  CASSETTE LOAD/SAVE CHECK OK	If displayed as the left, it is OK. If "CHECK NG" is displayed, it is NG.	

Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
22	Audio output check Depress SPACE Key.	CRT Screen Displays:  OCTAVE 2 OCTAVE 4 OCTAVE 6 When the beep sound is outputted, the corresponding indicator turns red.	If the TV is in the state as the followings, it is OK. 1) "do" in the octave 2 beeps from the channel A, "mi" in it beeps from the channel B, and "so" in it beeps from the channel C. 2) "do" in the octave 4 beeps from the channel A, "mi" in it beeps from the channel B, and "so" in it beeps from the channel C. 3) "do" in the octave 6 beeps from the channel A, "mi" in it beeps from the channel B, and "so" in it beeps from the channel C. 4) When the beep sound is outputted, the corresponding indicator turns red.	<Important test points> PSC, Sound output circuit, terminals, audio cable, CRT Octave check
		CRT Screen Displays:  Volume 5 Volume 10 Volume 15 When the beep sound is outputted, the corresponding indicator turns red.	If the TV is in the state as the followings, it is OK. 1) "do" in the volume 5 beeps from the channel A, "mi" in it beeps from the channel B, and "so" in it beeps from the channel C. 2) "do" in the volume 10 beeps from the channel A, "mi" in it beeps from the channel B, and "so" in it beeps from the channel C. 3) "do" in the volume 15 beeps from the channel A, "mi" in it beeps from the channel B, and "so" in it beeps from the channel C. 4) When the beep sound is outputted, the corresponding indicator turns red.	Volume check
		CRT Screen Displays:  NOISE 11 NOISE 21 NOISE 31 When the sound is outputted, the corresponding indicator turns red.	If the TV is in the state as the followings, it is OK. 1) "noise 11" sound is outputted from the channels A, B, and C. 2) "noise 21" sound is outputted from the channels A, B, and C. 3) "noise 31" sound is outputted from the channels A, B, and C. 4) When the sound is outputted, the corresponding indicator turns red.	"Noise" sound check

Step	Testing Procedure	CRT Screen displays or Printer prints out	Criteria	Remarks
		CRT Screen Displays: 	If the TV is in the state as the followings, it is OK. 1) When the sound is outputted, the corresponding indicator turns red. 2) The beeps sound like a crossing bell.	Envelope check
23	Depress SPACE Key.	CRT Screen Displays: 		
24	Turn off the Printer, TV and Computer. Note: When turning the computer on/off, perform it after turning the printer off.			Note: Do not turn on the power immediately after turning off the power. Wait at least 30 seconds after turning off the power before turning it back on.

Block Diagram



Disassembly Instruction

Cabinet

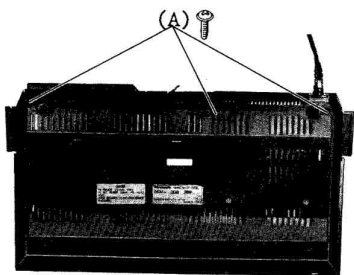


Fig. 28

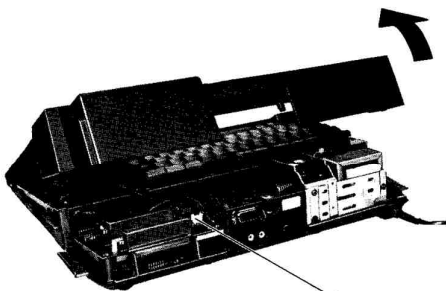
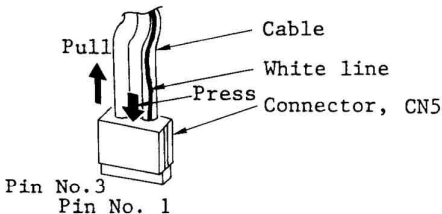


Fig. 29 (B)

Ref. No.	Procedure	Shown in Fig.-	To remove-.	Remove-.
1	1	Fig. 28	Top Cabinet	Screw (3 x 6).....(A) x 3
2	1-2	Fig. 29		• Cable for the Micro Switches (B)
3	1-3			Pull the Top Cabinet in the direction of arrow.

•Note:

- 1) When disconnecting the cable for the Micro Switches from the Connector CN5, remove it, pressing the top of the Connector.
- 2) When connecting the cable to the Connector CN5, make sure proper connection.
(The lead coloured white must be connected to Pin 1 of the Connector.)



Keyboard

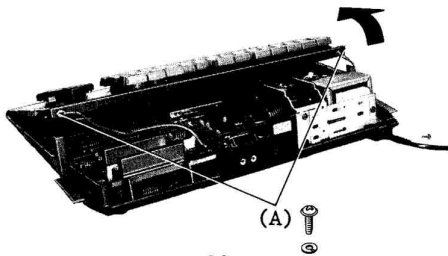


Fig. 30

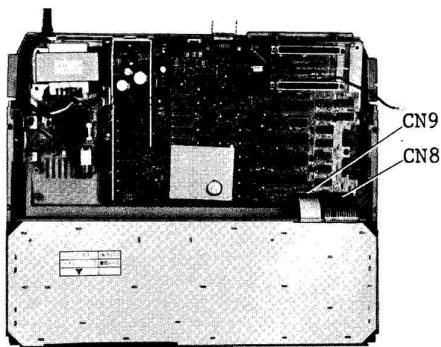
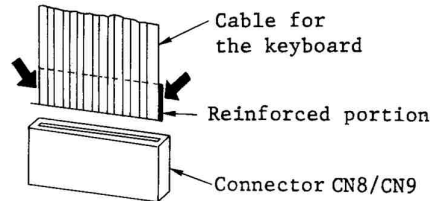


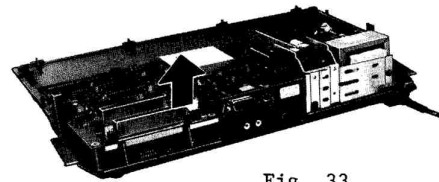
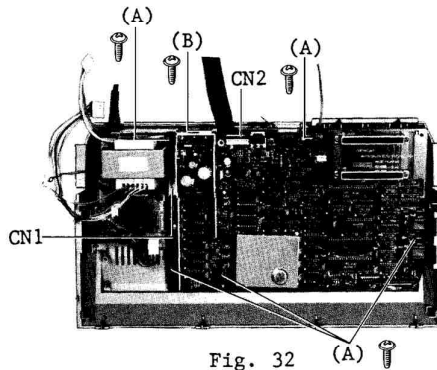
Fig. 31

Ref. No.	Procedure	Shown in Fig.-	To remove-	Remove-
4	1-5	Fig. 30	Keyboard	Screw (3 x 6).....(A) x 2
5				Pull the Keyboard in the direction of arrow.
6	1-6	Fig. 31		•Remove the cables of the keyboard from the Connector CN8, CN9.

- Note: Care should be taken during connection/disconnection of the cable for the Keyboard. With the both sides of the reinforced portion being held, connect/disconnect them.

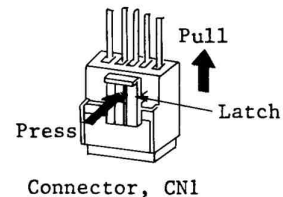


Main Board



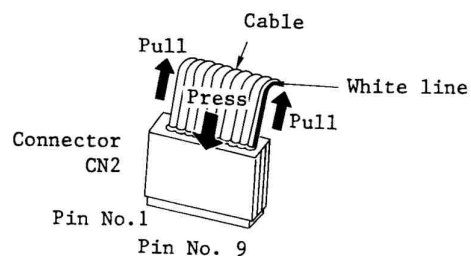
Ref. No.	Procedure	Shown in Fig.-	To remove-	Remove-
7	1-7	Fig. 32	Main Board	Screw (3 x 10).....(A) x 5 Screw (3 x 8).....(B) x 1
8	1-3, 8			•Remove the Socket from the connector, CN1 and CN2.
9	1-9	Fig. 33		Pull the Main Board in the direction of arrow.

- Note: When disconnecting the Socket from the Connector CN1, remove it with the latch being pressed.



•Note:

- 1) When disconnecting the cable from the Connector CN2, remove it, pressing the top of the Connector CN2.
- 2) When connecting the cable to the Connector CN2, make sure proper connection.
(The lead coloured white must be connected to Pin 9 of the Connector.)



Video Board

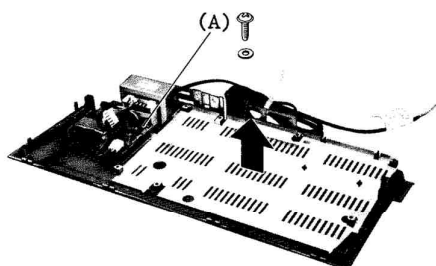


Fig. 34

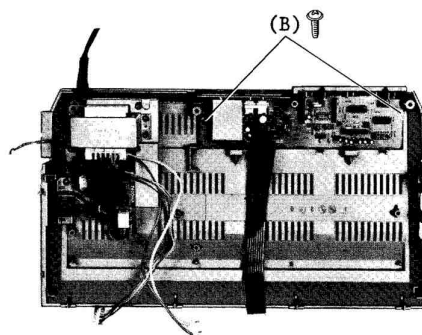


Fig. 35

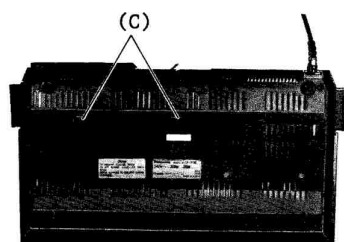


Fig. 36

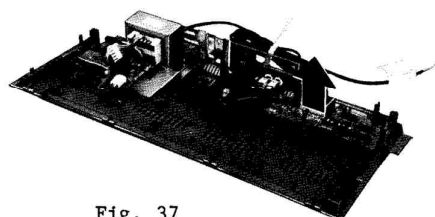
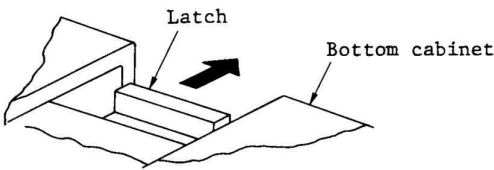


Fig. 37

Ref. No.	Procedure	Shown in Fig.-	To remove-	Remove-
10	1-11	Fig. 34	Shield Plate	Screw (3 x 8).....(A) x 1
11				Pull the Shield Plate in the direction of arrow.
12	1-12	Fig. 35	Video Board	Screw (3 x 10).....(B) x 2
13	1-13	Fig. 36		•Unlatch the latch of the bottom cabinet. (C) x 2
14	1-14	Fig. 37		Pull the Video Board in the direction of arrow.

• Note: When unlatching, avoid applying excessive force to the latch for the rupture.



Power Source Board

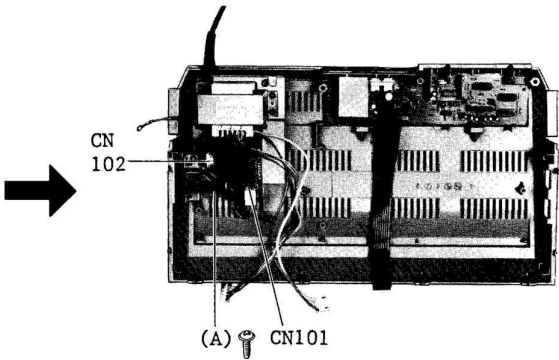
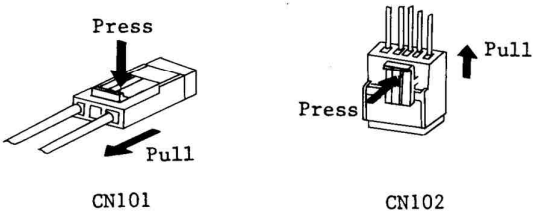


Fig. 38

Ref. No.	Procedure	Shown in Fig.-	To remove-.	Remove-.
15	7-10, 15	Fig. 38	Power Source Board	Screw (3 x 8).....(A) x 1
16	7-10, 15, 16			• Remove the Socket from the Connector, CN101 and CN102.
17	7-11, 15-17			Pull the Power Source Board in the direction of arrow.

• Note: When disconnecting the Socket from the Connector, remove it with the latch being pressed.



Slot Panel, Slot Cover

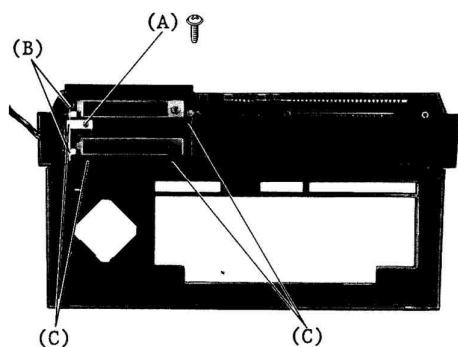


Fig. 39

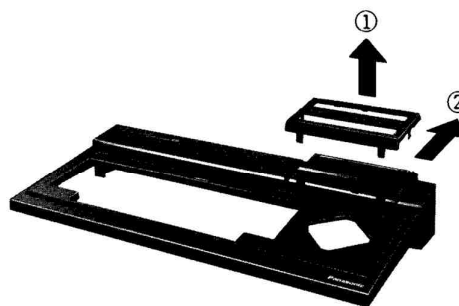
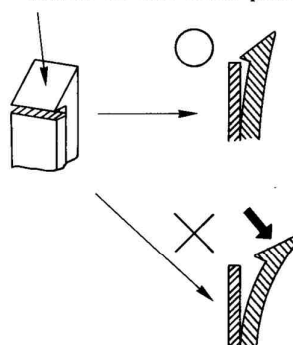


Fig. 40

Ref. No.	Procedure	Shown in Fig.-	To remove-.	Remove-.
18	1-3, 18, 19	Fig. 39	Micro Switches	Screw (3 x 10).....(A) x 1
19				Micro Switch..... (B) x 2
20	1-3, 18-20	Fig. 40	Slot Panel	•Unlatch the latches of the Slot Panel..... (C) x 4
21	1-3, 18-21			Remove the Slot Panel in the direction of arrow ①
22	1-3, 18-22		Slot Cover	Remove the Slot Cover in the direction of arrow ②

•Note: Care should be taken during disassembly, so as not to damage the slot panel.
When unlatching, avoid applying excessive force to the latch for rupture.

Latch of the slot panel



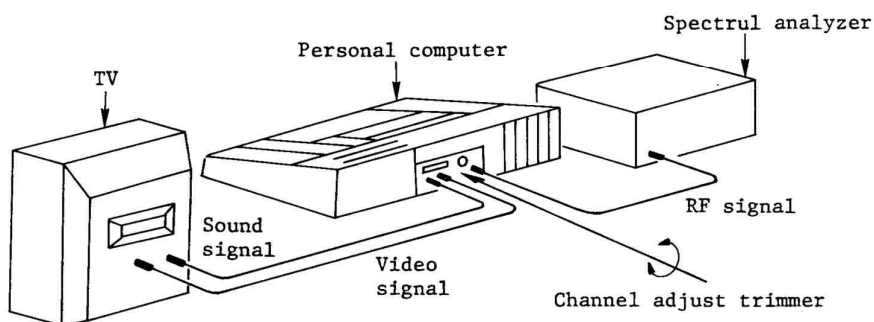
Adjustment

Channel adjust trimmer

After connecting the TV and computer, turn on the power switch. Set the TV to UHF channels 35-37. Insert the adjustment screwdriver into the channel adjust trimmer and adjust for a clear picture.

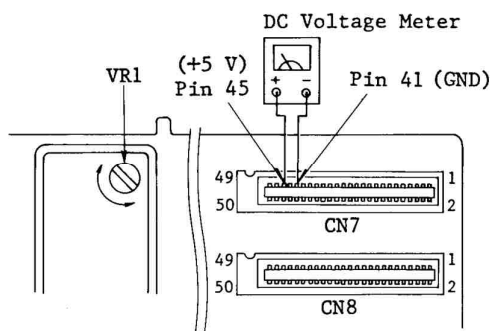
If there is a Spectral Analyzer, adjustment can be performed precisely. Connect the Spectral Analyzer to RF output jack of the computer. Then, adjust the channel adjust trimmer as follows.

Channel	Frequency (MHz)
35	583.25
36	591.25
37	599.25



Power Source

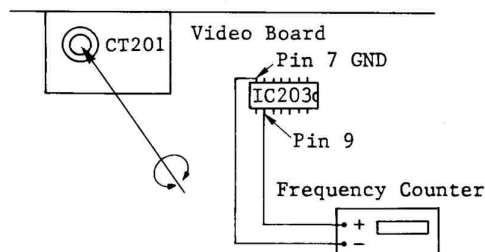
Adjust the VR1 so that the DC voltage at Pin 45 of the connector CN7 is within 4.97-5.03 V.



Clock Frequency

Connect the clips of the Frequency counter to the Pin 9 of IC203 on Video Board.

Adjust Trimmer Capacitor, CT201, for 4.43361875 MHz $\pm$ 3 Hz reading on Frequency Counter.



Connector Pin Connection

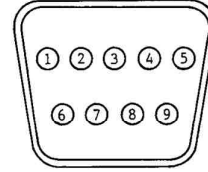
General Port 1 and General Port 2 (D-sub 9-pin)

Signal level TTL level

Signal Lines List

Terminal Number	Signal Name	I/O
1	FWD	I
2	BACK	I
3	LEFT	I
4	RIGHT	I
5	+5 V	(Note 2)
6	TRG 1	I/O
7	TRG 2	I/O
8	Output	0
9	GND	-

(Note 1)



(Note 3) (Front view of the panel-mounted connector)

Note 1: Input or output with respect to the computer

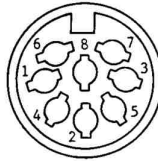
Note 2: Load current 50 mA or less

Note 3: I/O is software controlled. To use an input, set bits 0 and 1 (for port 1) or bits 2 and 3 (for port 2) at PSG port B to high level.

Cassette I/O Port (DIN8-pin)

Signal Lines List

Terminal Number	Signal Name
1	GND
2	GND
3	GND
4	CMTOUT
5	CMTIN
6	REM +
7	REM -
8	GND



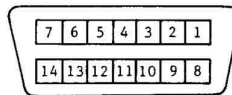
(Front view of the panel-mounted connector)

Printer Port (Amphenol 14-pin)

Signal level TTL level

Signal Lines List

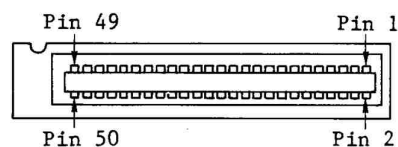
Terminal Number	Signal Name	I/O (Note 1)	Terminal Number	Signal Name	I/O (Note 1)
1	PSTB	0	8		0
2	DATA 0	0	9	DATA 7	0
3	DATA 1	0	10		
4	DATA 2	0	11	BUSY	1
5	DATA 3	0	12		
6	DATA 4	0	13		
7	DATA 5	0	14	GND	-



(Front view of the panel-mounted connector)

Note 1: Input or output with respective to the computer.

Slot 1 and Slot 2
(Card edge type, 50-pin, 2.54 mm pitch)



(Front view of the
panel-mounted connector)

Signal level TTL level

Signal Lines List

(Note 1)

(Note 1)

Terminal Number	Name	I/O	Terminal Number	Name	I/O
1	CS1	0	2	CS2	0
3	CS12	0	4	SLTSL	0
5	(Note 2)	-	6	RFSH	0
7	WAIT (Note 3)	I	8	INT (Note 3)	I
9	MI	0	10	BUSDIR	I
11	IORQ	0	12	MERQ	0
13	WR	0	14	RD	0
15	RESET	0	16	(Note 2)	-
17	A9	0	18	A15	0
19	A11	0	20	A10	0
21	A7	0	22	A6	0
23	A12	0	24	A8	0
25	A14	0	26	A13	0
27	A1	0	28	A0	0
29	A3	0	30	A2	0
31	A5	0	32	A4	0
33	D1	I/O	34	D0	I/O
35	D3	I/O	36	D2	I/O
37	D5	I/O	38	D4	I/O
39	D7	I/O	40	D6	I/O
41	GND	-	42	CLOCK	0
43	GND	-	44	SW1	-
45	+5 V (Note 4)	-	46	SW2	-
47	+5 V (Note 4)	-	48	+12 V (Note 5)	-
49	SUNDIN	I	50	-12 V (Note 6)	-

Note 1: Input or output with respect to the computer

Note 2: System reserve terminal

Note 3: Be sure to input using an open collector output

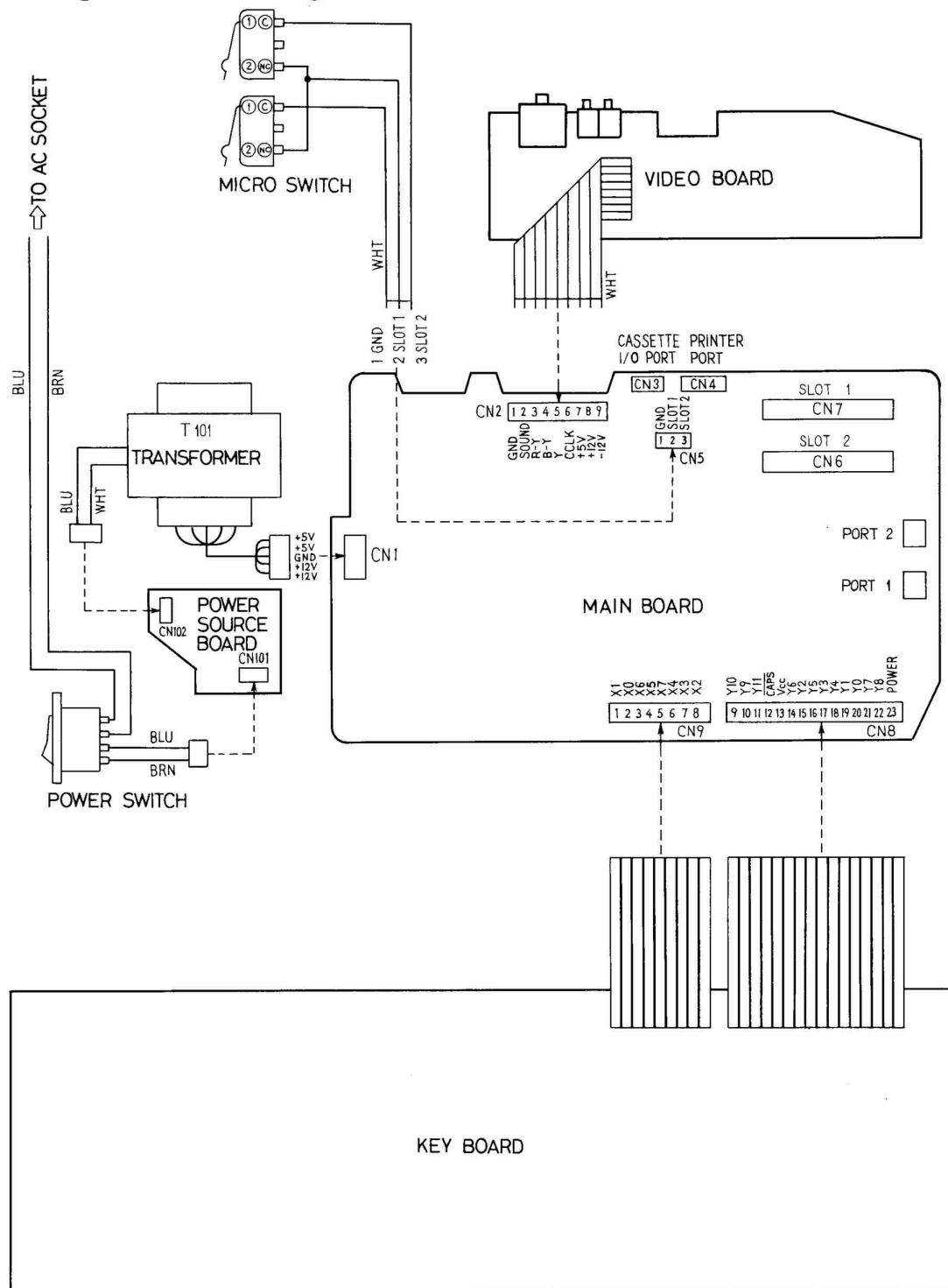
Note 4: Load current 300 mA or less

Note 5: Load current 50 mA or less

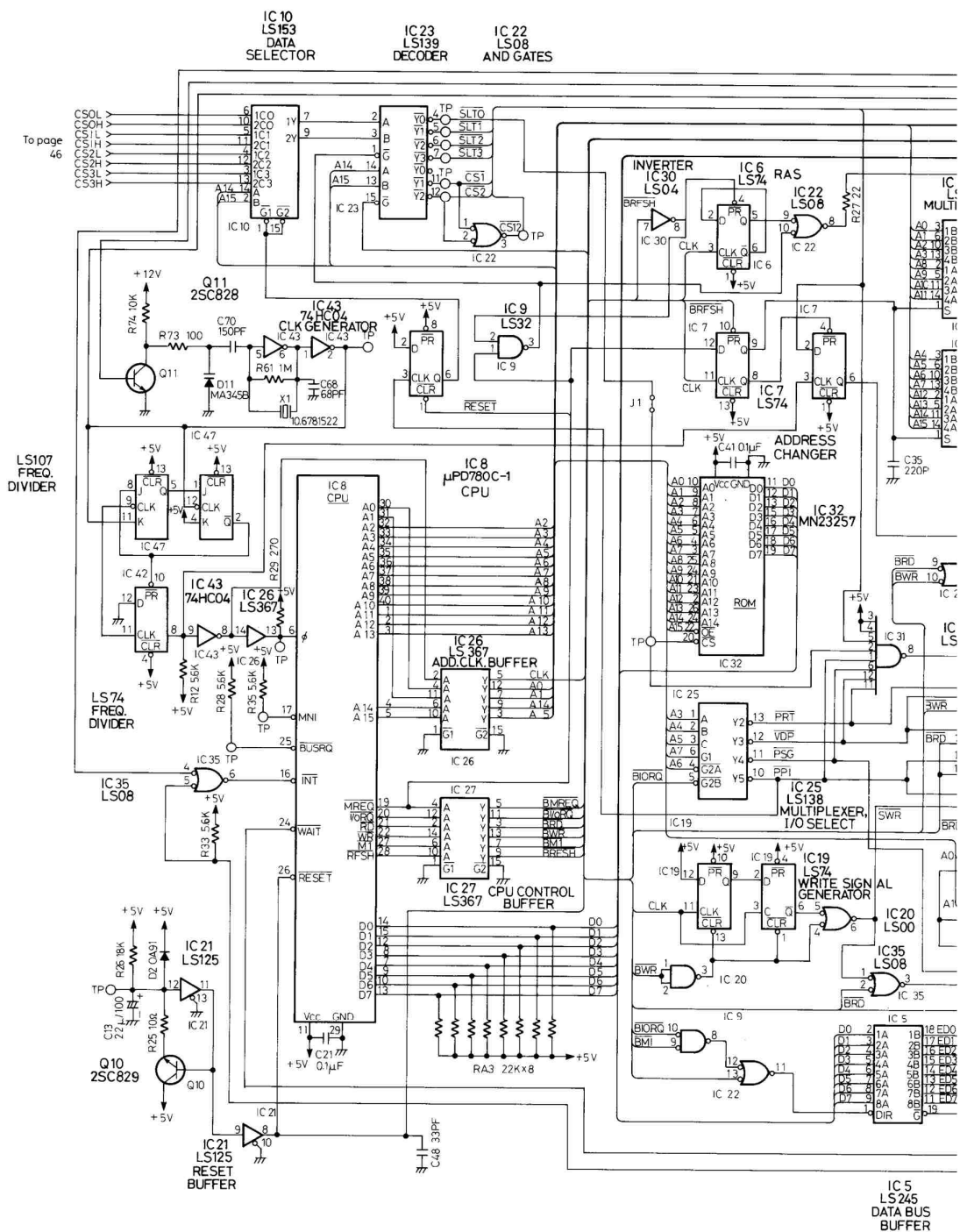
Note 6: Load current 50 mA or less

Note 7: Be sure to fully understand the signals before actual
designing a slot connected interface.

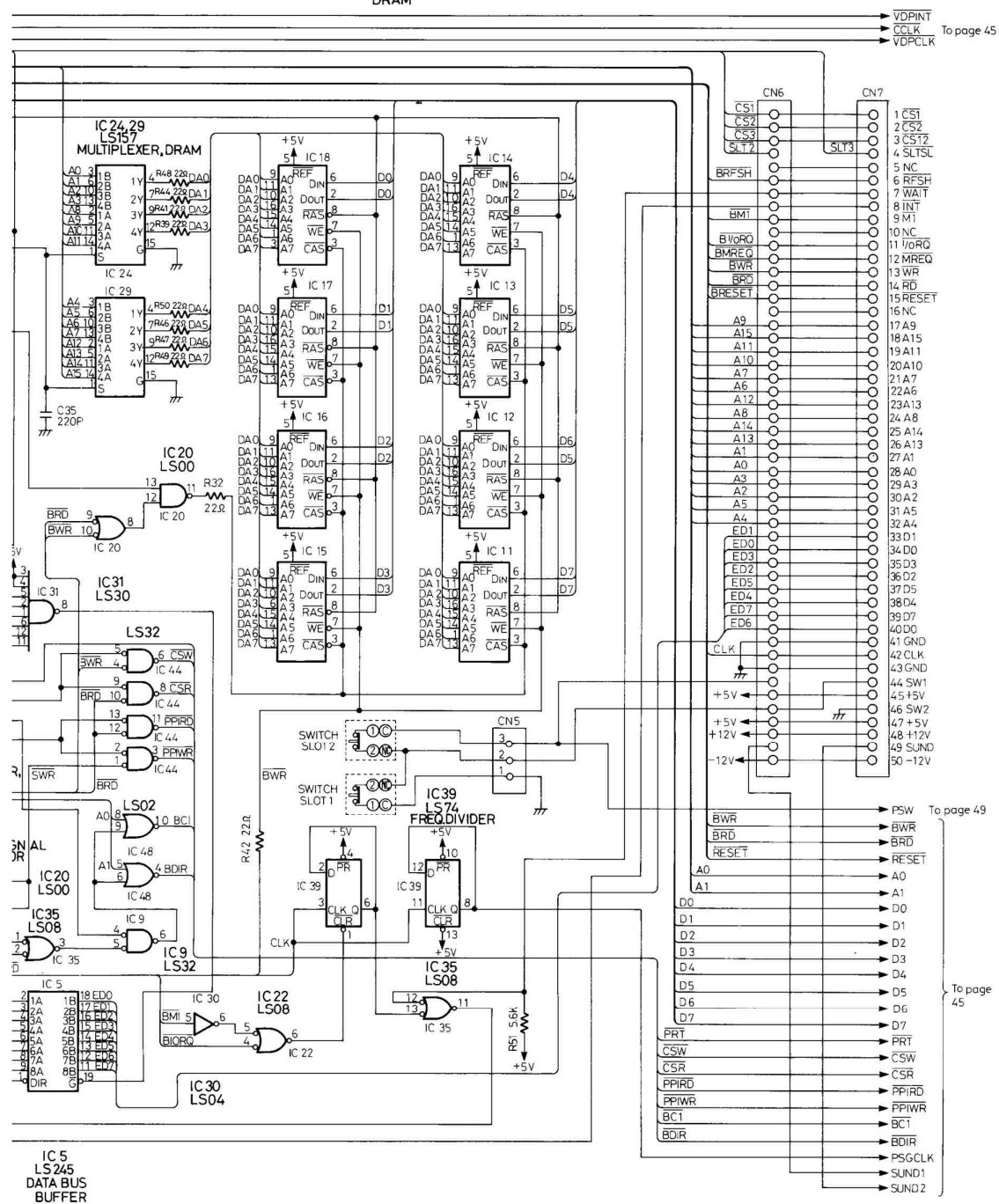
Wiring Connection Diagram



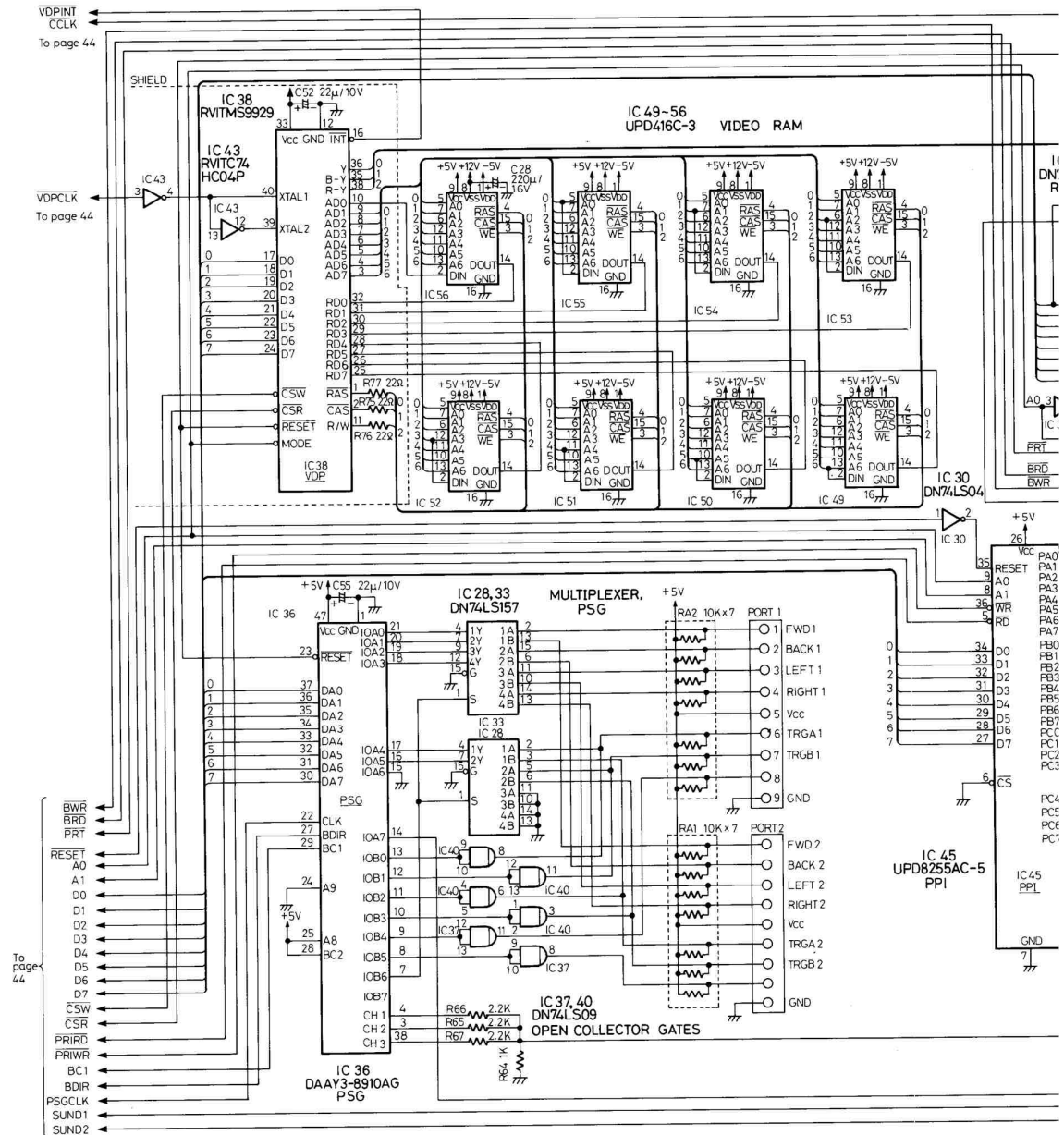
Schematic Diagram (Main Board)



IC11~IC18
MSK4164ANL-12
DRAM

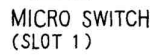


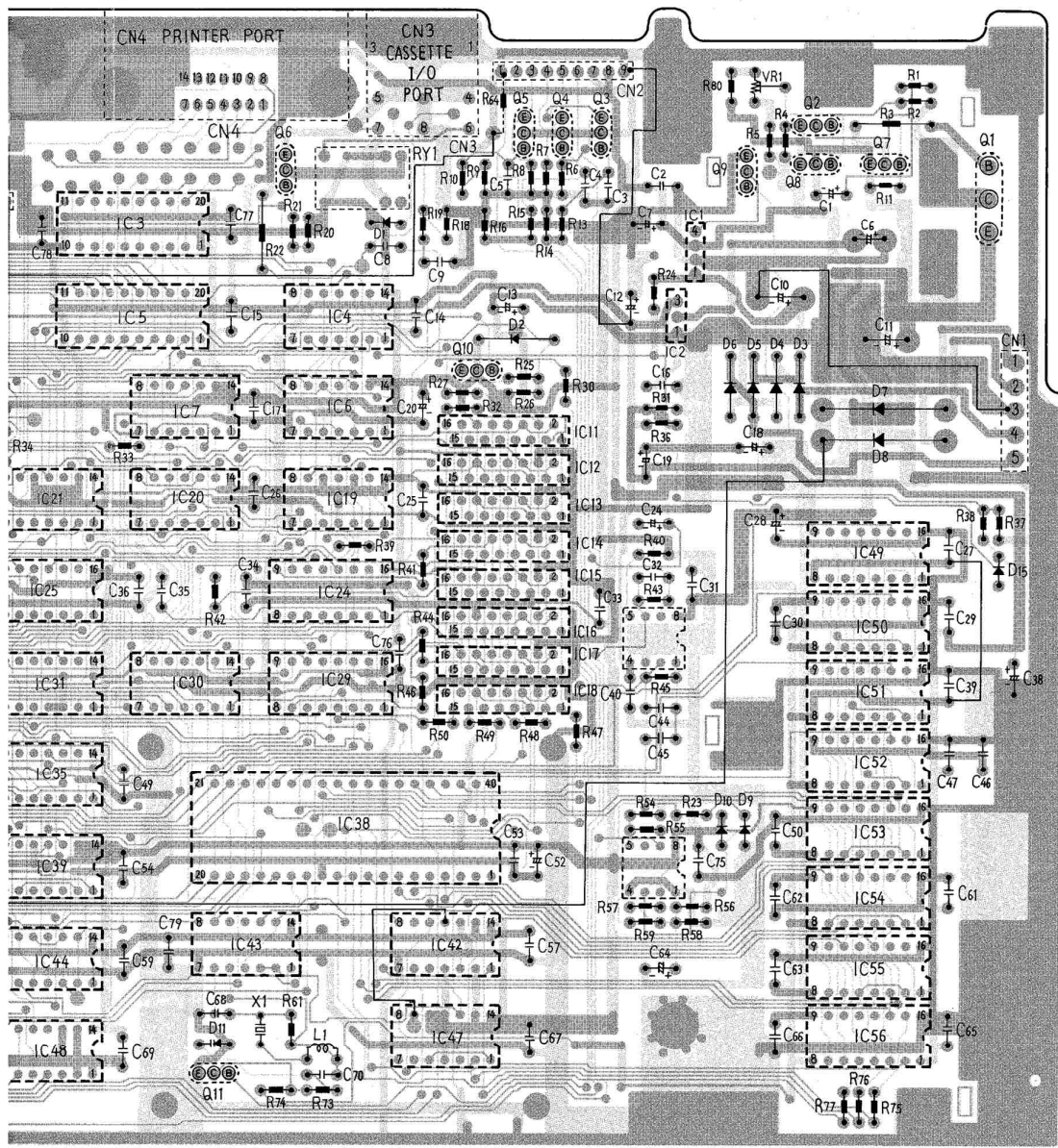
Schematic Diagram (Main Board)



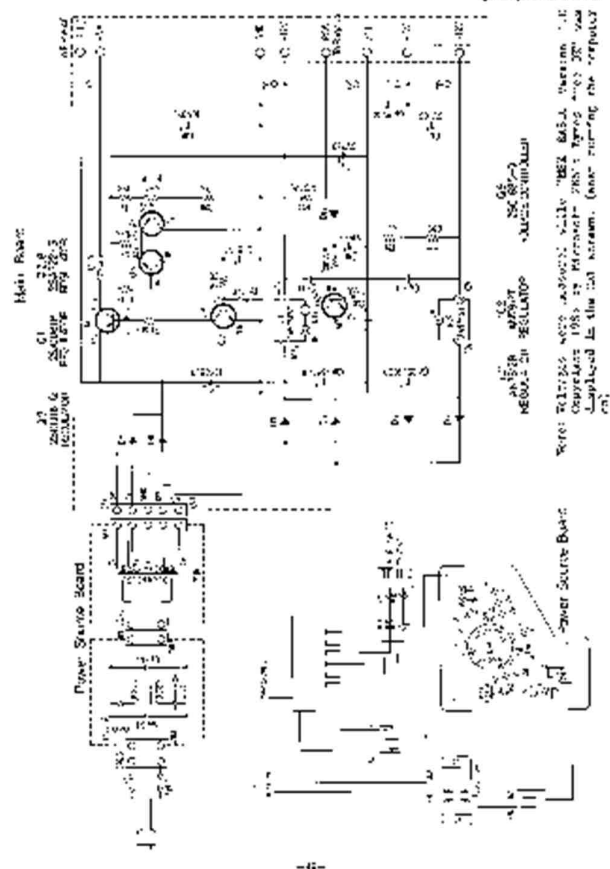


MICRO SWITCH
(SLOT 2)

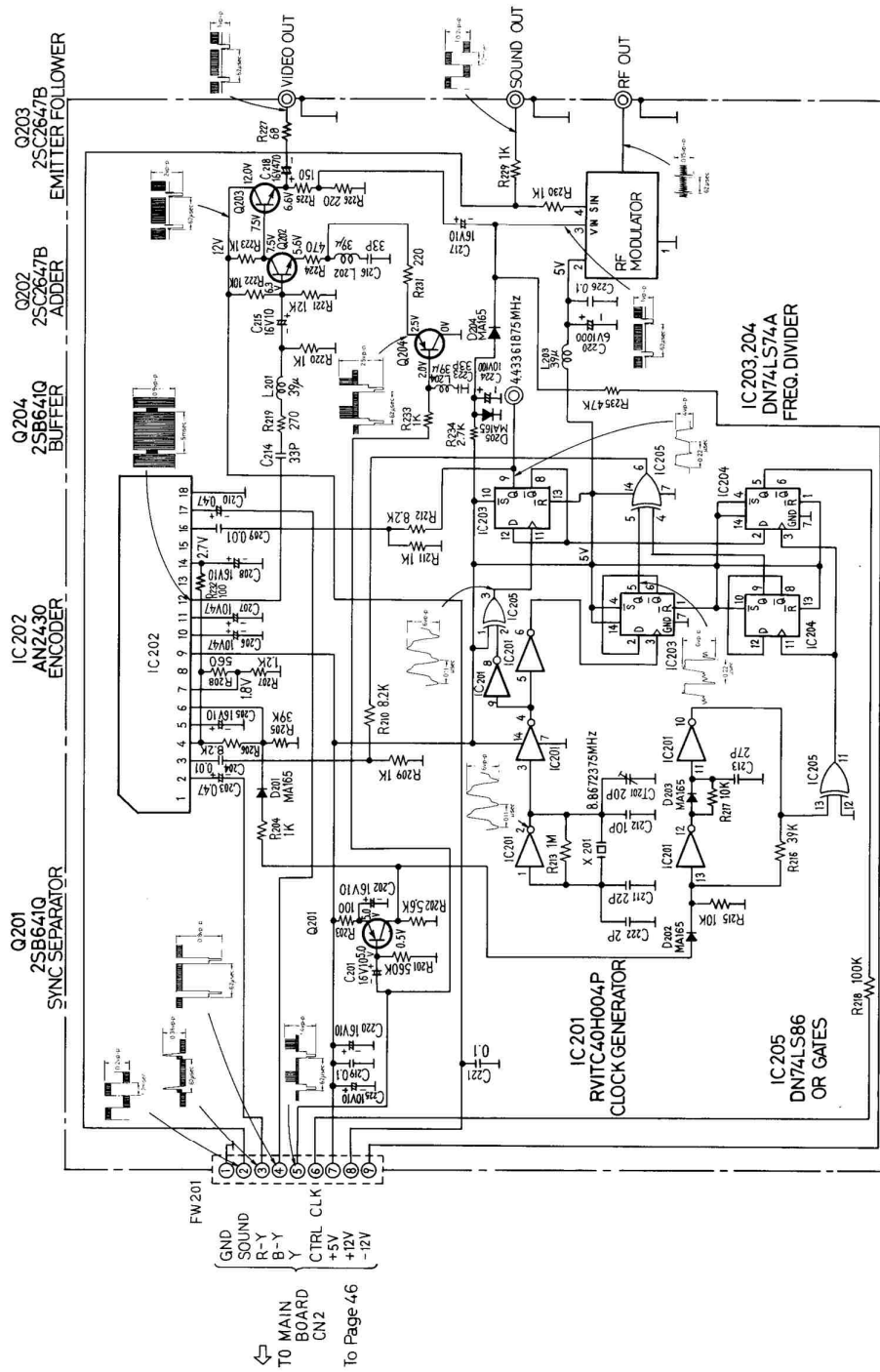




Schematic Diagram & Printed Circuit Board (Power Source) **& Main Board**

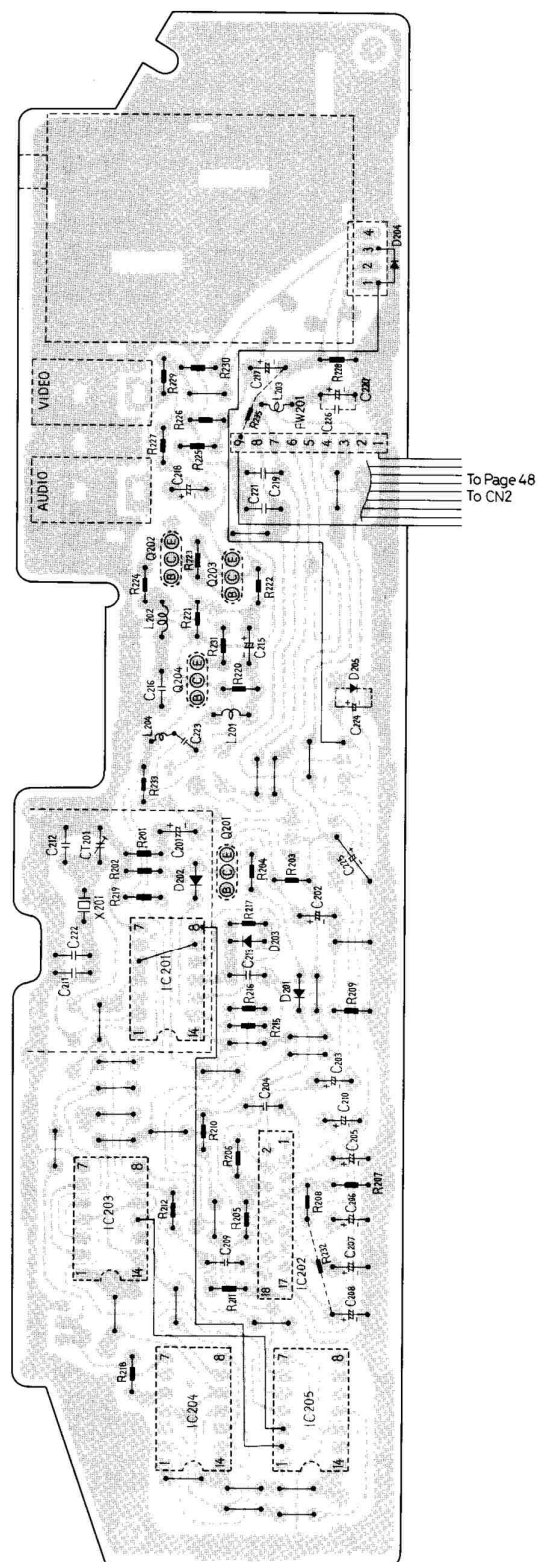


Schematic Diagram (Video Board)



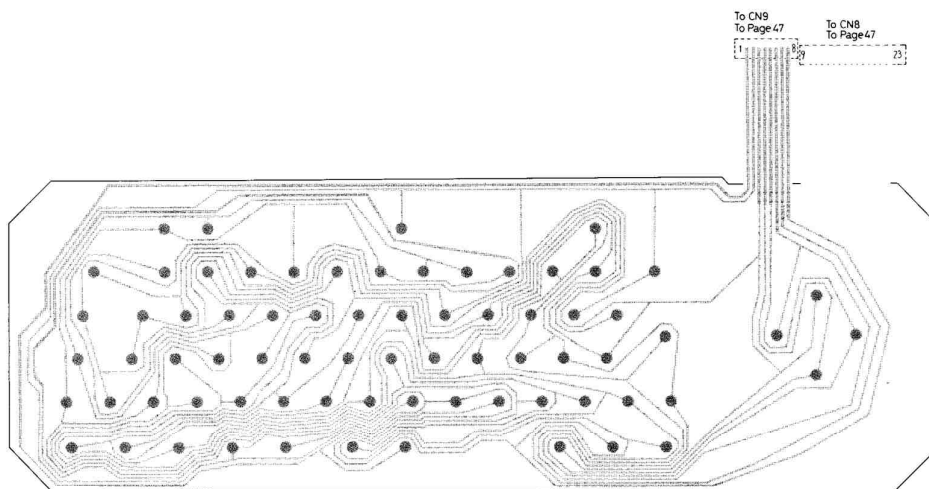
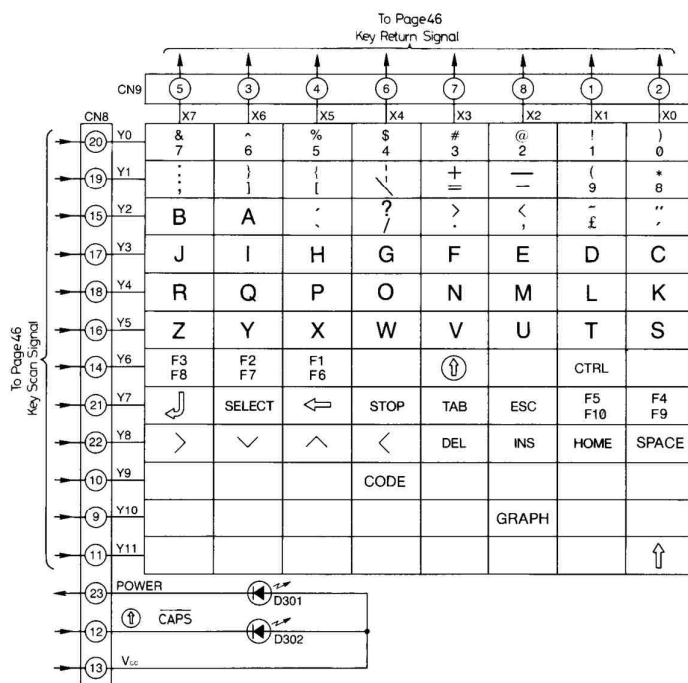
Note: Waveforms and Voltages were measured while "MSX BASIC Version 1.0 Copyright 1983 by Microsoft 28815 Bytes free OK" was displayed in the CRT screen. (When turning the computer on)
 For waveform of sound, the sound "A" was beeped by following programming.
 (10: PLAY "AAAAAAA")
 (20: GOTO 10)

Printed Circuit Board (Video Board)



Printed Circuit Board (Keyboard)

Keyboard Matrix



Note: When the Keytop is depressed, contacts of both flexible patterns (,) contact each other.

IC Block Diagram

74 Families of TTL Circuits

- (1) DN74LS00
- (2) DN74LS02
- (3) DN74LS04/RVITC74HC04P
- (4) DN74LS08
- (5) DN74LS09
- (6) DN74LS30
- (7) DN74LS32
- (8) DN74LS74A
- (9) DN74LS86
- (10) DN74LS107
- (11) DN74LS125A
- (12) DN74LS138
- (13) DN74LS139
- (14) DN74LS145
- (15) DN74LS153
- (16) DN74LS157
- (17) DN74LS245
- (18) DN74LS273
- (19) DN74LS367A

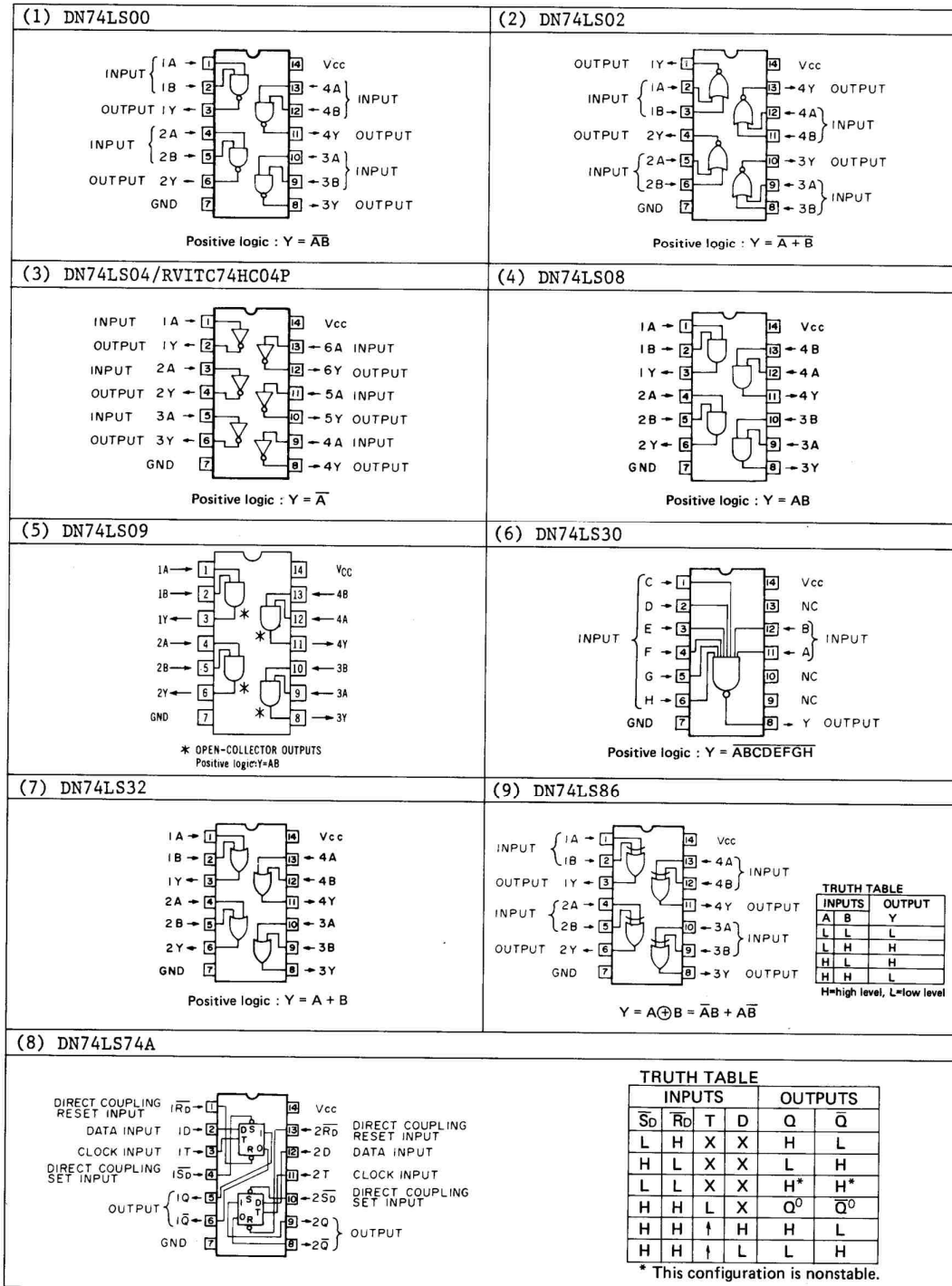
Others IC

- (20) AN2430
- (21) AN6553
- (22) AN7812R
- (23) AN7912T
- (24) DA4164ANL12M
- (25) DAAY3-8910AG
- (26) MN23257CFH
- (27) RVITC40H004P
- (28) RVITMS9929AJ
- (29) UPC311C
- (30) UPD416C-3
- (31) UPD780C-1
- (32) UPD8255AC-5

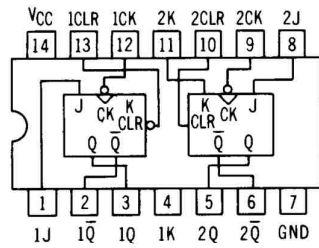
EXPLANATION OF TRUTH TABLES

The following symbols are now being used in truth tables.

- H = high level (steady state)
- L = low level (steady state)
- ↑ = transition from low to high level
- ↓ = transition from high to low level
- X = irrelevant (any input, including transitions)
- Z = off (high-impedance) state of a 3-state output
- a..h = the level of steady-state inputs at inputs A through H respectively
- Q_0 = level of Q before the indicated steady-state input conditions were established
- $\overline{Q}_0$ = complement of Q_0 or level of $\overline{Q}$ before the indicated steady-state input conditions were established
- Q_n = level of Q before the most recent active transition indicated by + or ↓
-  = one high-level pulse
-  = one low-level pulse



(10) DN74LS107

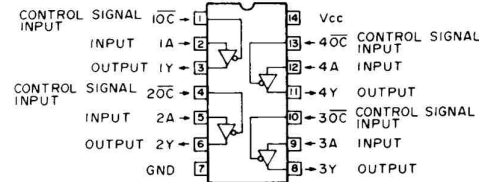


TRUTH TABLE

INPUTS				OUTPUTS	
CLR	CLK	J	K	Q	Q̄
L	X	X	X	L	H
H	$\downarrow$	L	L	Q ₀	Q̄ ₀
H	$\downarrow$	H	L	H	L
H	$\downarrow$	L	H	L	H
H	$\downarrow$	H	H	TOGGLE	TOGGLE

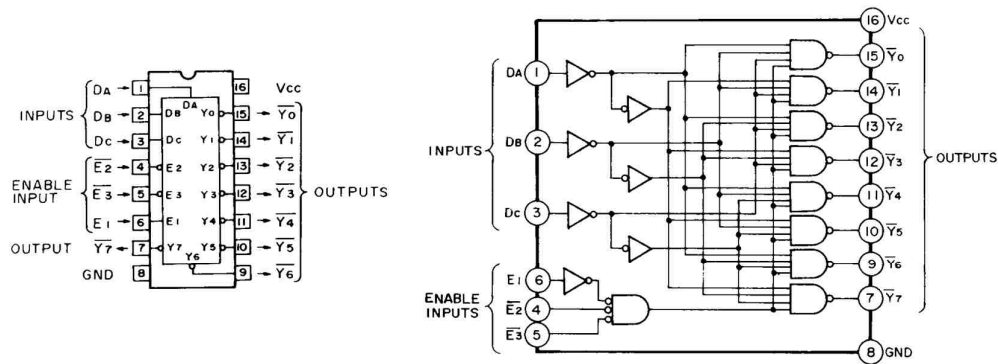
X = irrelevant

(11) DN74LS125A



Positive logic : Y = A Output is off (disabled) when $\overline{OC}$ is high

(12) DN74LS138

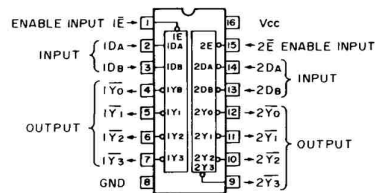


TRUTH TABLE

INPUTS		OUTPUTS										
ENA-BLE	SELECT	Y ₀	Y ₁	Y ₂	Y ₃	Y ₄	Y ₅	Y ₆	Y ₇	Y ₈	Y ₉	Y ₁₀
E ₁	E ₂	D ₀	D ₁	D ₂	Y ₀	Y ₁	Y ₂	Y ₃	Y ₄	Y ₅	Y ₆	Y ₇
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

$\overline{E}_x = \overline{E}_2 + \overline{E}_3$ X = irrelevant

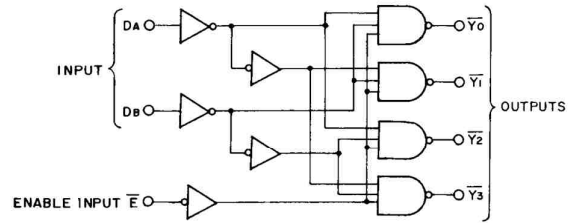
(13) DN74LS139



TRUTH TABLE

INPUTS				OUTPUTS			
E	D _B	D _A	D _C	Y ₀	Y ₁	Y ₂	Y ₃
H	X	X	X	H	H	H	H
L	L	L	L	H	H	H	H
L	L	H	H	L	H	H	H
L	H	L	H	H	L	H	H
L	H	H	L	H	H	L	H
L	H	H	H	H	H	H	L

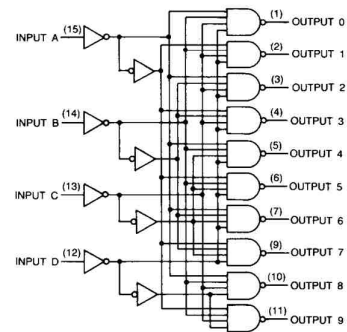
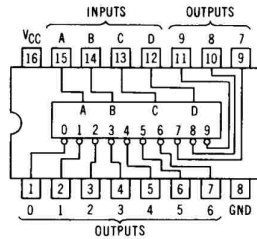
X=irrelevant



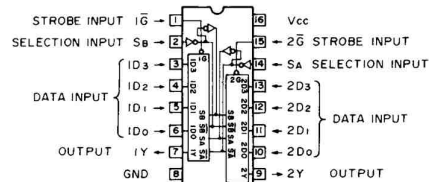
(14) DN74LS145

TRUTH TABLE

NO	INPUTS				OUTPUTS													
	D	C	B	A	0	1	2	3	4	5	6	7	8	9	0	1	2	3
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
1	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
2	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
3	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
4	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
5	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
6	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
7	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
8	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
9	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
INVALID	H	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
	H	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
	H	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
	H	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
	H	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H
	H	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H



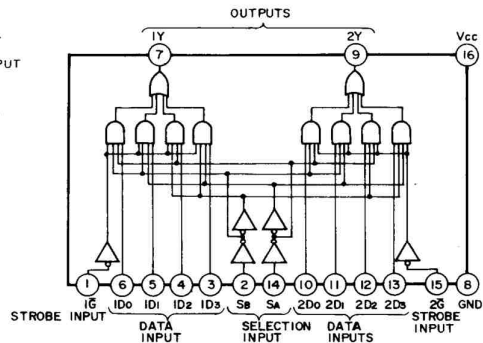
(15) DN74LS153



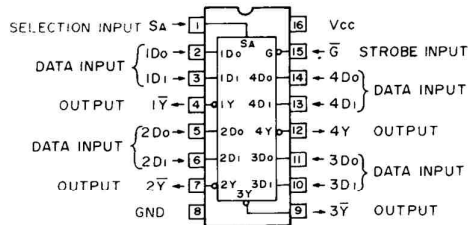
TRUTH TABLE

INPUTS							OUTPUTS
S _B	S _A	D ₀	D ₁	D ₂	D ₃	G	Y
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
L	H	X	X	X	X	L	L
L	H	X	H	X	X	L	H
H	L	X	X	L	X	L	L
H	L	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

X=irrelevant



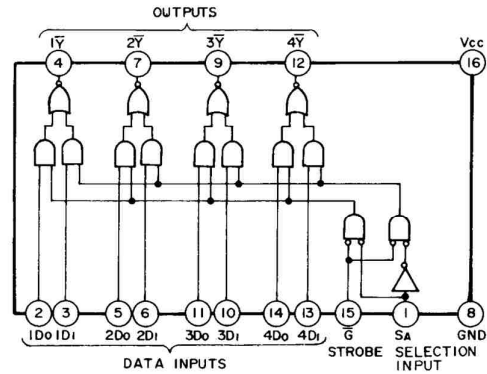
(16) DN74LS157



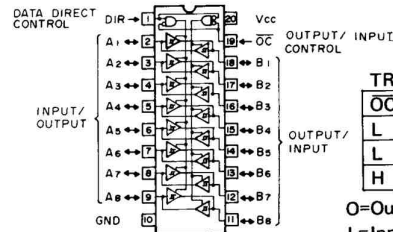
TRUTH TABLE

INPUTS				OUTPUTS
G	SA	D ₀	D ₁	Y
H	X	X	X	H
L	L	L	X	H
L	L	H	X	L
L	H	X	L	H
L	H	X	H	L

X=irrelevant



(17) DN74LS245

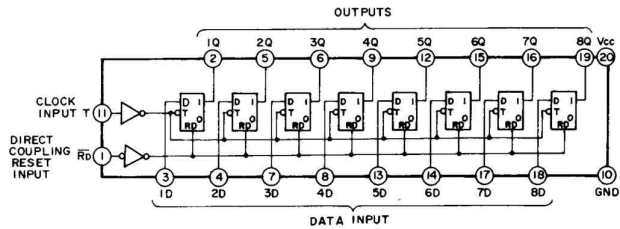
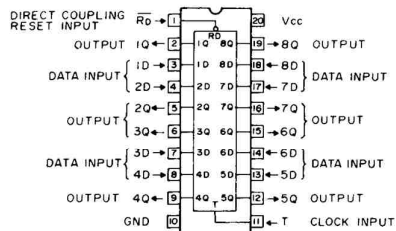


TRUTH TABLE

OC	DIR	A	B
L	L	O	I
L	H	I	O
H	X	Z	Z

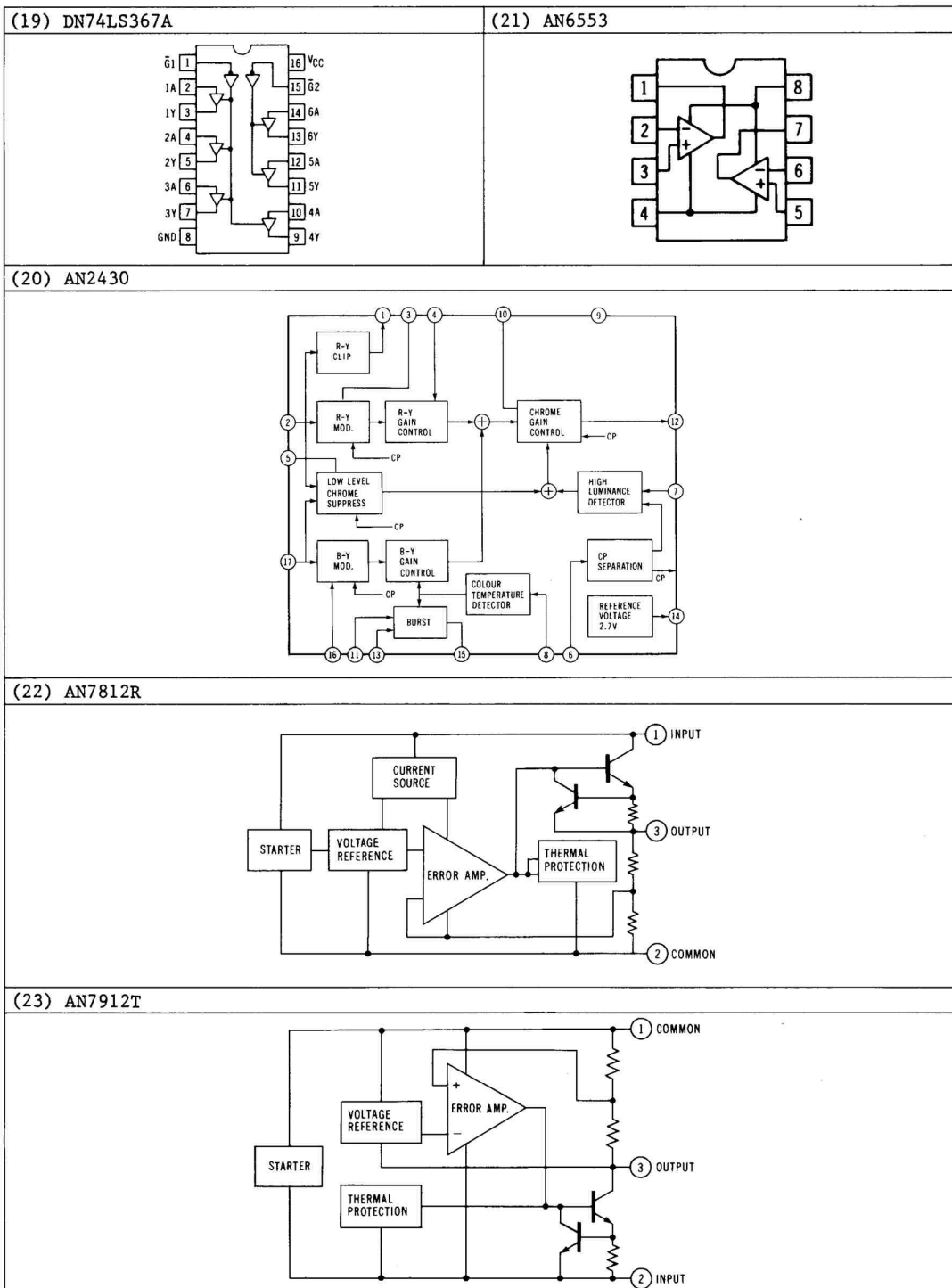
O=Output terminal
I=Input terminal

(18) DN74LS273

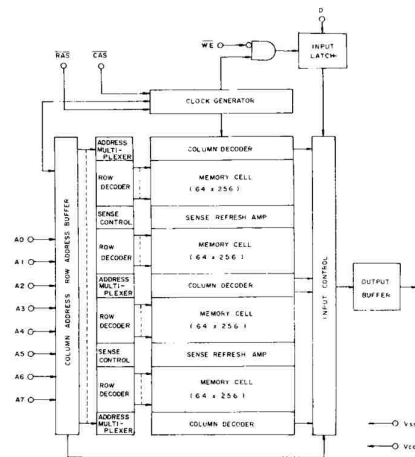
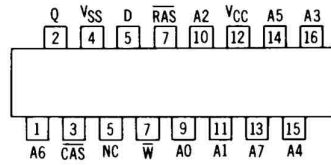


TRUTH TABLE

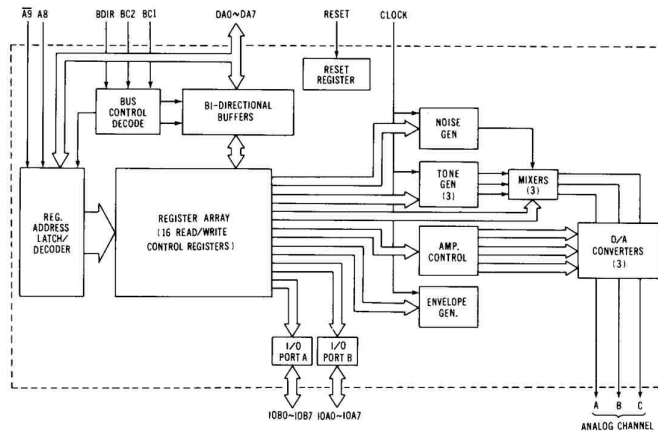
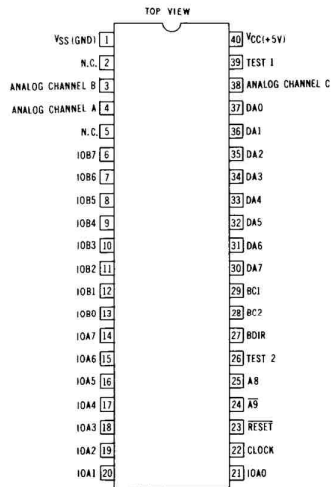
INPUTS			OUTPUT
R ₀	T	D	Q
L	X	X	L
H	↑	H	H
H	↑	L	L
H	L	X	Q ⁰



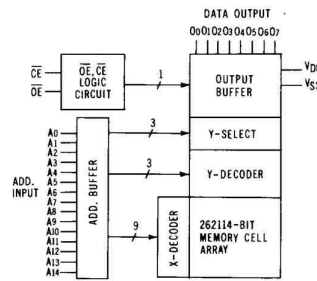
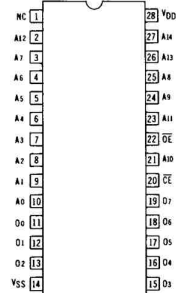
(24) DA4164ANL12M



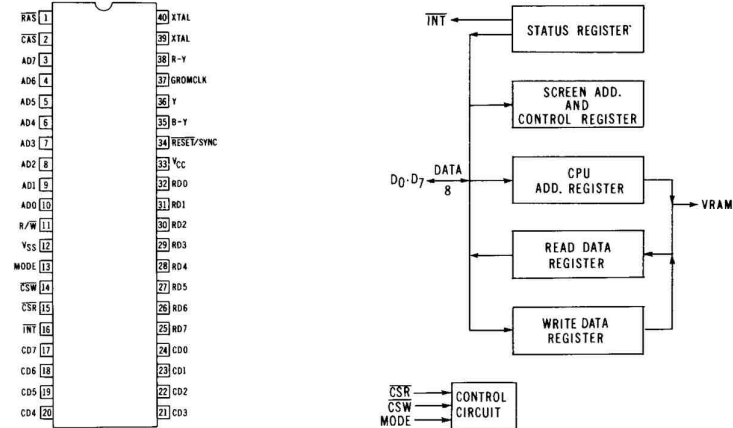
(25) DAAY3-8910AG



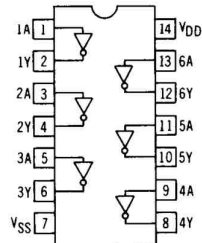
(26) MN23257CFH



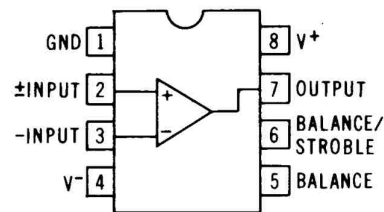
(28) RVITMS9929AJ



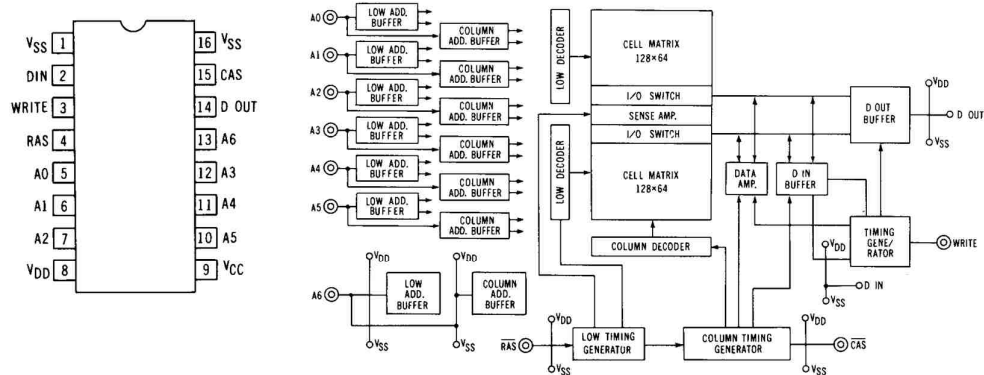
(27) RVITC40H004P



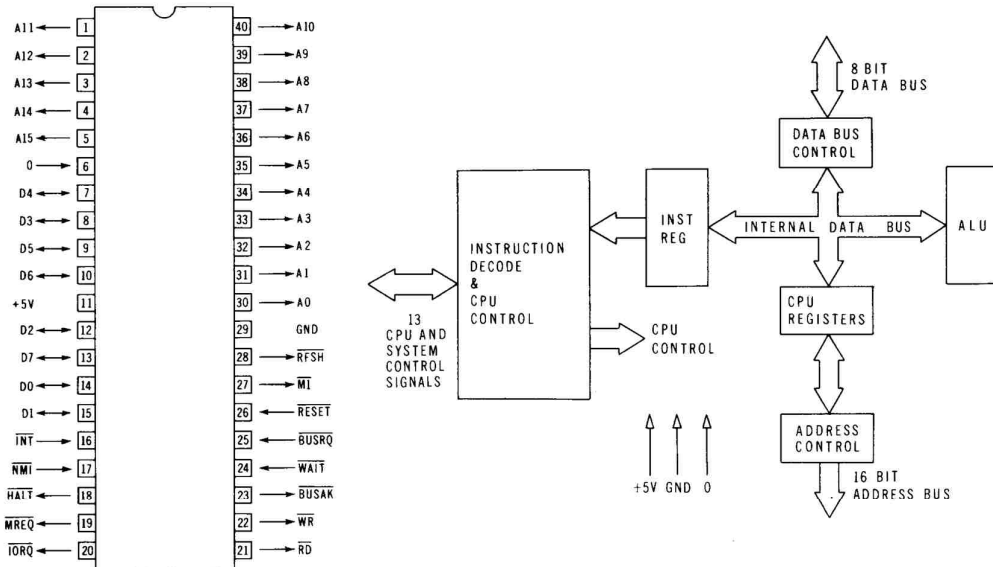
(29) UPC311C



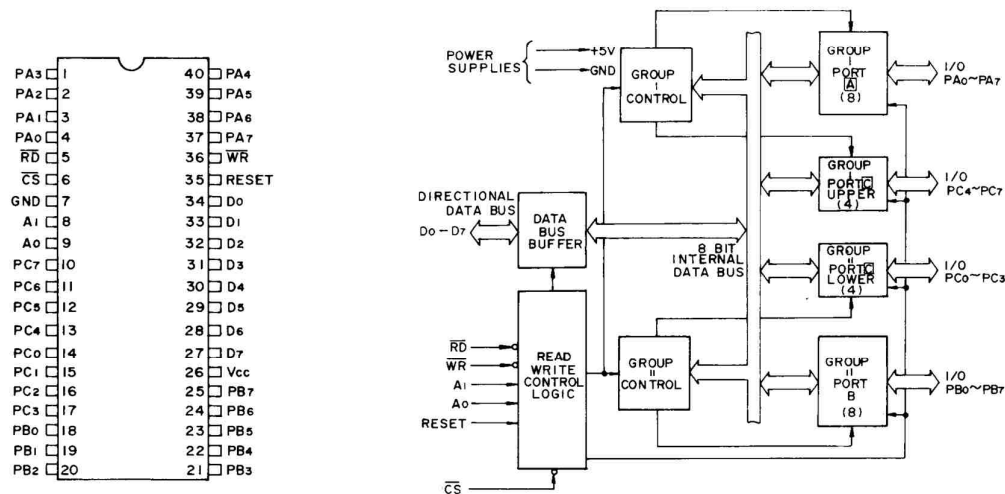
(30) UPD416C-3



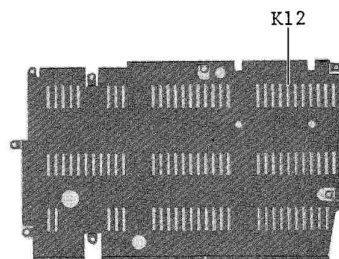
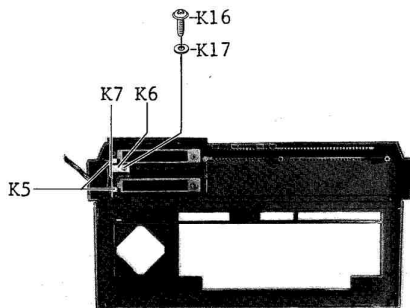
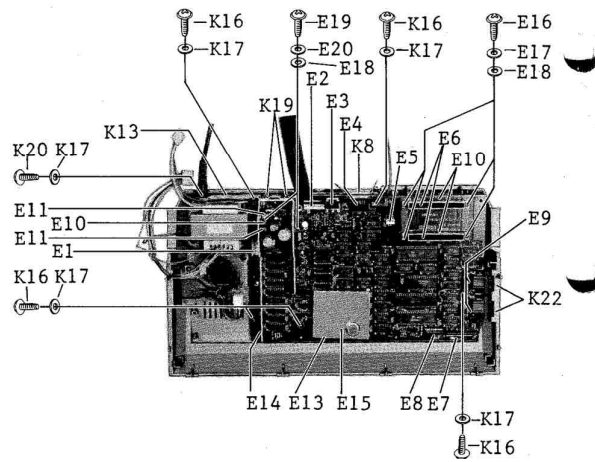
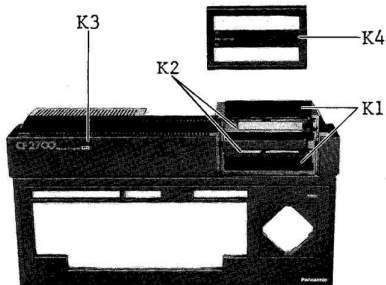
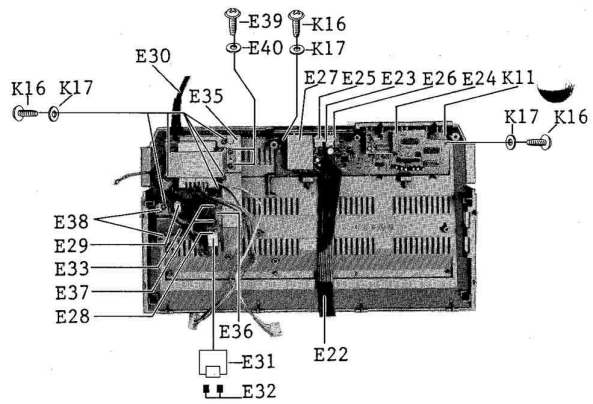
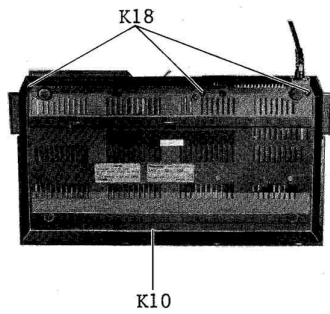
(31) UPD780C-1



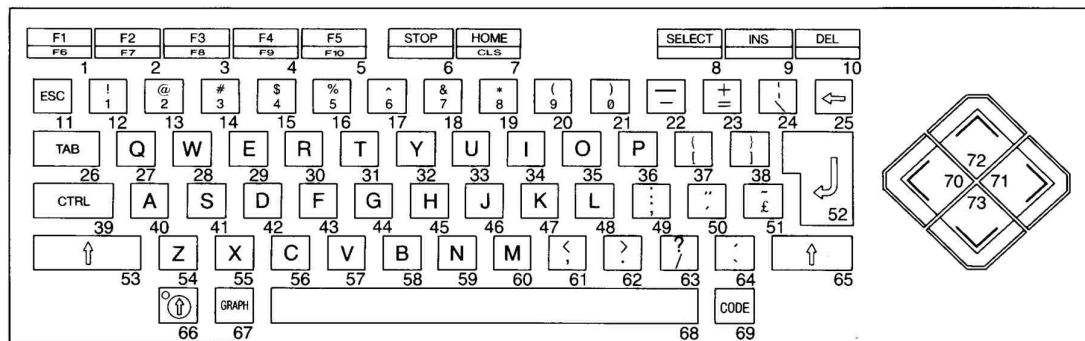
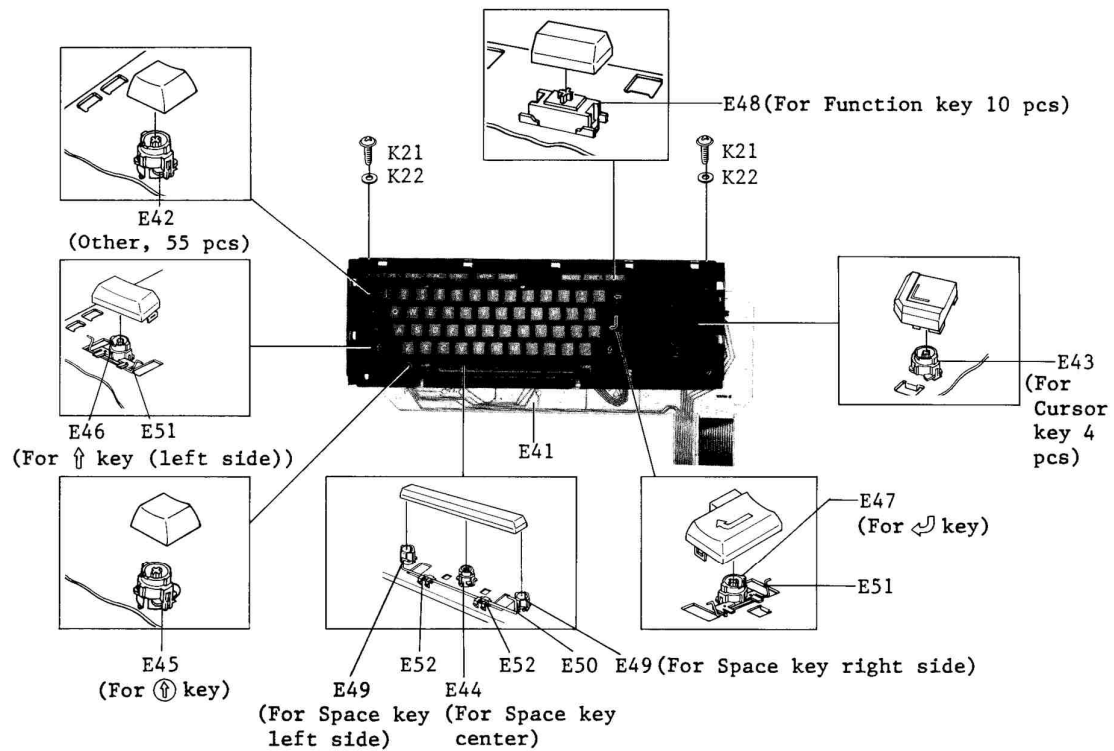
(32) UPD8255AC-5



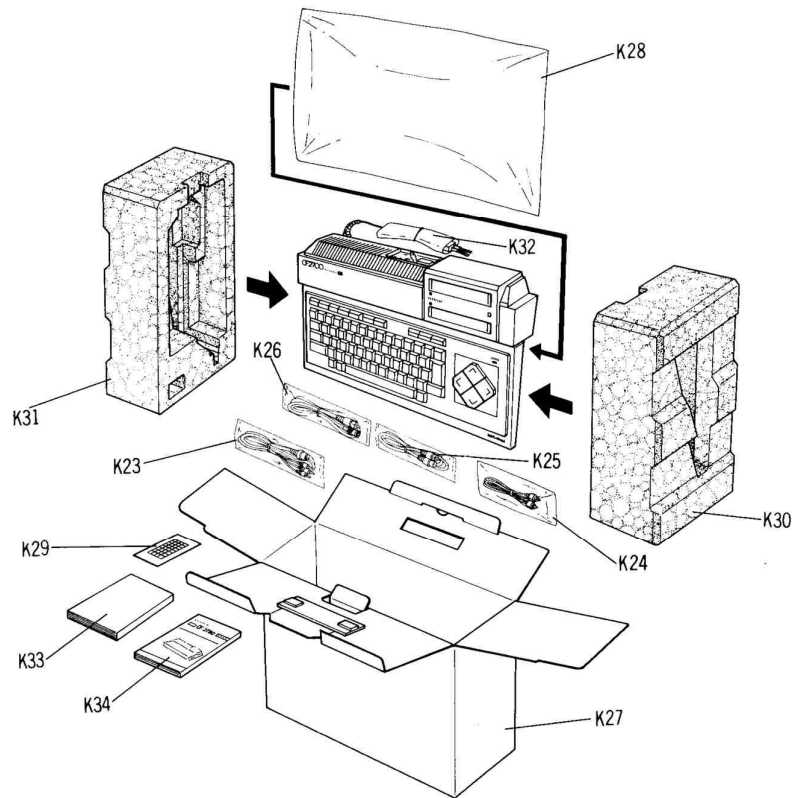
Parts Location



Parts Location (Keyboard)



Packing Instruction



Replacement Parts List CF-2700

Notes: 1. Parts Name and Location.
 Components identified by Δ mark have special characteristics important for safety. When replacing any of these components, use only manufacturer's specified parts.
 2. The S mark indicates service standard parts and may differ from production parts.

Ref. No.	Part No.	Part Name & Description	Per Set	Ref. No.	Part No.	Part Name & Description	Per Set
MAIN P.C. BOARD BLOCK				IC20	DN74LS00	IC, QUADRUPLE NAND GATES	1
IC1	AN7812R	IC, REGULATOR	1	IC21	DN74LS125A	IC, RESET BUFFER	1
IC2	AN7912T	IC, REGULATOR	1	IC22	DN74LS08	IC, QUADRUPLE AND GATES	1
IC3	DN74LS273	IC, DATA LATCH	1	IC23	DN74LS139	IC, DECODER, SLOT	1
IC4	DN74LS32	IC, QUADRUPLE OR GATES	1	IC24	DN74LS157	IC, MULTIPLEXER, DRAM	1
IC5	DN74LS245	IC, DATA BUS BUFFER	1	IC25	DN74LS138	IC, MULTIPLEXER, I/O SELECT	1
IC6	DN74LS74A	IC, RAS	1	IC26	DN74LS367A	IC, ADDRESS CLOCK BUFFER	1
IC7	DN74LS74A	IC, ADDRESS CHANGER	1	IC27	DN74LS367A	IC, CPU CONTROL BUFFER	1
IC8	UPD780C-1	IC, CPU	1	IC28	DN74LS157	IC, MULTIPLEXER, PSG	1
IC9	DN74LS32	IC, QUADRUPLE OR GATES	1	IC29	DN74LS157	IC, MULTIPLEXER, DRAM	1
IC10	DN74LS153	IC, DATA SELECTOR, SLOT	1	IC30	DN74LS04	IC, INVERTERS	1
IC11	DA4164ANL12M	IC, DYNAMIC RAM	1	IC31	DN74LS30	IC, POSITIVE NAND GATES	1
IC12	DA4164ANL12M	IC, DYNAMIC RAM	1	IC32	MN23257CFH	IC, MASK ROM	1
IC13	DA4164ANL12M	IC, DYNAMIC RAM	1	IC33	DN74LS157	IC, MULTIPLEXER, PSG	1
IC14	DA4164ANL12M	IC, DYNAMIC RAM	1	IC34	AN6553	IC, OP AMP	1
IC15	DA4164ANL12M	IC, DYNAMIC RAM	1	IC35	DN74LS08	IC, QUADRUPLE AND GATES	1
IC16	DA4164ANL12M	IC, DYNAMIC RAM	1	IC36	DAAY3-8910A	IC, PSG (PROGRAMMABLE SOUND GENERATOR)	1
IC17	DA4164ANL12M	IC, DYNAMIC RAM	1	IC37	DN74LS09	IC, OPEN COLLECTOR GATES	1
IC18	DA4164ANL12M	IC, DYNAMIC RAM	1	IC38	RVITMS9929AJ	IC, VDP (VIDEO DISPLAY PROCESSOR)	1
IC19	DN74LS74A	IC, WRITE SIGNAL GENERATOR	1	IC39	DN74LS74A	IC, FREQUENCY DIVIDER	1

Ref. No.	Part No.	Part Name & Description	Per Set	Ref. No.	Part No.	Part Name & Description	Per Set
IC40	DN74LS09	IC, OPEN COLLECTOR GATES	1	R29	ERDS2TJ271	Register 270 ohms	1
IC41	UPC311C	IC, COMPARATOR	1	R30	ERDS2TJ392	Register 3.9K ohms	1
IC42	DN74LS74A	IC, FREQUENCY DIVIDER	1	R31	ERDS2TJ471	Register 470 ohms	1
IC43	RVITC74HC04P	IC, OSCILLATOR	1	R32	ERDS2TJ220	Register 22 ohms	1
IC44	DN74LS32	IC, QUADRUPLE OR GATES	1	R33	ERDS2TJ562	Register 5.6K ohms	1
IC45	UPD8255AC-5	IC, PPI (PROGRAMMABLE PERIPHERAL INTERFACE)	1	R34	ERDS2TJ103	Register 10K ohms	1
IC46	DN74LS145	IC, KEYBOARD INTERFACE	1	R35	ERDS2TJ562	Register 5.6K ohms	1
IC47	DN74LS107	IC, FREQUENCY DIVIDER	1	R36	ERDS2TJ681	Register 680 ohms	1
IC48	DN74LS02	IC, QUADRUPLE NOR GATES	1	R37	ERDS2TJ563	Register 56K ohms	1
IC49	UPD416C-3	IC, VIDEO RAM	1	R38	ERDS2TJ273	Register 27K ohms	1
IC50	UPD416C-3	IC, VIDEO RAM	1	R39	ERDS2TJ220	Register 22 ohms	1
IC51	UPD416C-3	IC, VIDEO RAM	1	R40	ERDS2TJ102	Register 1K ohms	1
IC52	UPD416C-3	IC, VIDEO RAM	1	R41	ERDS2TJ220	Register 22 ohms	1
IC53	UPD416C-3	IC, VIDEO RAM	1	R42	ERDS2TJ220	Register 22 ohms	1
IC54	UPD416C-3	IC, VIDEO RAM	1	R43	ERDS2TJ472	Register 4.7K ohms	1
IC55	UPD416C-3	IC, VIDEO RAM	1	R44	ERDS2TJ220	Register 22 ohms	1
IC56	UPD416C-3	IC, VIDEO RAM	1	R45	ERDS2TJ183	Register 18K ohms	1
Q1	2SA1061P	Transistor	1	R46	ERDS2TJ220	Register 22 ohms	1
Q2	2SA722-S	Transistor	1	R47	ERDS2TJ220	Register 22 ohms	1
Q3	2SC829-B	Transistor	1	R48	ERDS2TJ220	Register 22 ohms	1
Q4	2SC829-B	Transistor	1	R49	ERDS2TJ220	Register 22 ohms	1
Q5	2SC829-B	Transistor	1	R50	ERDS2TJ220	Register 22 ohms	1
Q6	2SC1685-Q	Transistor	1	R51	ERDS2TJ562	Register 5.6K ohms	1
Q7	2SC1318-Q	Transistor	1	R52	ERDS2TJ680	Register 68 ohms	1
Q8	2SA722-S	Transistor	1	R53	ERDS2TJ103	Register 10K ohms	1
Q9	2SC1685-Q	Transistor	1	R54	ERDS2TJ102	Register 1K ohms	1
Q10	2SC829-B	Transistor	1	R55	ERDS2TJ224	Register 220K ohms	1
Q11	2SC1685-Q	Transistor	1	R56	ERDS2TJ222	Register 2.2K ohms	1
D1	MA165	Diode	1	R57	ERDS2TJ472	Register 4.7K ohms	1
D2	OA91LF	Diode	1	R58	ERDS2TJ222	Register 2.2K ohms	1
D3	FBM-032-009	Diode	1	R59	ERDS2TJ103	Register 10K ohms	1
D4	FBM-032-009	Diode	1	R61	ERDS2TJ105	Register 1M ohms	1
D5	FBM-032-009	Diode	1	R62	ERDS2TJ103	Register 10K ohms	1
D6	FBM-032-009	Diode	1	R63	ERDS2TJ680	Register 68 ohms	1
D7	DEDS3V20F4	Diode	1	R64	ERD25TJ102	Register 1K ohms	1
D8	DEDS3V20F4	Diode	1	R65	ERDS2TJ222	Register 2.2K ohms	1
D9	MA165	Diode	1	R66	ERDS2TJ222	Register 2.2K ohms	1
D10	MA165	Diode	1	R67	ERDS2TJ222	Register 2.2K ohms	1
D11	MA345B	Diode	1	R68	ERDS2TJ472	Register 4.7K ohms	1
D12	OA95	Diode	1	R69	ERDS2TJ223	Register 22K ohms	1
D13	OA95	Diode	1	R70	ERDS2TJ472	Register 4.7K ohms	1
D14	OA95	Diode	1	R71	ERDS2TJ472	Register 4.7K ohms	1
D15	MA165	Diode	1	R72	ERDS2TJ182	Register 1.8K ohms	1
X1	DECA10678K1M	Crystal	1	R73	ERDS2TJ104	Register 100K ohms	1
RY1	FBM-450-004	Relay	1	R74	ERDS2TJ103	Register 10K ohms	1
RA1	EXBP87103J	Component Combination	1	R75	ERDS2TJ220	Register 22 ohms	1
RA2	EXBP87103J	Component Combination	1	R76	ERDS2TJ220	Register 22 ohms	1
RA3	EXBP88103J	Component Combination	1	R77	ERDS2TJ220	Register 22 ohms	1
RA4	EXBP88223J	Component Combination	1	R80	ERDS2TJ103	Register 10K ohms	1
VR1	DENC1B222	Variable Register volume	1	C1	ECEALHV010	Capacitor 1 µF	1
R1	ERDS2TJ102	Register 1K ohms	1	C2	ECFF1E104ZF	Capacitor 0.1 µF	1
R2	ERDS2TJ102	Register 1K ohms	1	C3	ECCF1H680JC	Capacitor 68 pF	1
R3	ERG1SJ680P	Register 68 ohms	1	C4	ECCF1H680JC	Capacitor 68 pF	1
R4	ERDS2TJ472	Register 4.7K ohms	1	C5	ECCF1H680JC	Capacitor 68 pF	1
R5	ERDS2TJ153	Register 15K ohms	1	C6	ECEALU102	Capacitor 1000 µF	1
R6	ERDS2TJ122	Register 1.2K ohms	1	C7	ECEALCU331	Capacitor 330 µF	1
R7	ERDS2TJ122	Register 1.2K ohms	1	C8	ECQV1H393JZ	Capacitor 0.039 µF	1
R8	ERDS2TJ122	Register 1.2K ohms	1	C9	ECQV1H103JZ	Capacitor 0.01 µF	1
R9	ERDS2TJ561	Register 560 ohms	1	C10	ECEALU472	Capacitor 4700 µF	1
R10	ERDS2TJ471	Register 470 ohms	1	C11	ECEALCU682	Capacitor 6800 µF	1
R11	ERDS2TJ472	Register 4.7K ohms	1	C12	ECEALCU101	Capacitor 100 µF	1
R12	ERDS2TJ562	Register 5.6K ohms	1	C13	ECEALAU220	Capacitor 22 µF	1
R13	ERDS2TJ471	Register 470 ohms	1	C14	ECFF1E104ZF	Capacitor 0.1 µF	1
R14	ERDS2TJ561	Register 560 ohms	1	C15	ECFF1E104ZF	Capacitor 0.1 µF	1
R15	ERDS2TJ471	Register 470 ohms	1	C16	ECFF1E104ZF	Capacitor 0.1 µF	1
R16	ERDS2TJ561	Register 560 ohms	1	C17	ECFF1E104ZF	Capacitor 0.1 µF	1
R18	ERDS2TJ101	Register 100 ohms	1	C18	ECEALAU331	Capacitor 330 µF	1
R19	ERDS2TJ472	Register 4.7K ohms	1	C19	ECEALAU101	Capacitor 100 µF	1
R20	ERDS2TJ222	Register 2.2K ohms	1	C20	ECSF1AE225	Capacitor 22 µF	1
R21	ERDS2TJ222	Register 2.2K ohms	1	C21	ECFF1E104ZF	Capacitor 0.1 µF	1
R22	ERD50TJ151	Register 150 ohms	1	C22	ECFF1E104ZF	Capacitor 0.1 µF	1
R24	ERG1AN471U	Register 470 ohms	1	C23	ECFF1E104ZF	Capacitor 0.1 µF	1
R25	ERDS2TJ100	Register 10 ohms	1	C24	ECEALAU101	Capacitor 100 µF	1
R26	ERDS2TJ183	Register 18K ohms	1	C25	ECFF1E104ZF	Capacitor 0.1 µF	1
R27	ERDS2TJ220	Register 22 ohms	1	C26	ECFF1E104ZF	Capacitor 0.1 µF	1
R28	ERDS2TJ562	Register 5.6K ohms	1	C27	ECFF1E104ZF	Capacitor 0.1 µF	1
				C28	ECSF1EE226	Capacitor 220 µF	1
				C29	ECFF1E104ZF	Capacitor 0.1 µF	1
				C30	ECFF1E104ZF	Capacitor 0.1 µF	1
				C31	ECFF1E104ZF	Capacitor 0.1 µF	1
				C32	ECKD1H222KB	Capacitor 2200 pF	1

Ref. No.	Part No.	Part Name & Description	Per Set	Ref. No.	Part No.	Part Name & Description	Per Set
C33	ECFF1E104ZF	Capacitor 0.1 μ F	1	Q203	2SC2647B	Transistor	1
C34	ECFF1E104ZF	Capacitor 0.1 μ F	1	Q204	2SB641Q	Transistor	1
C35	ECKD1H221KB	Capacitor 220 pF	1				
C36	ECFF1E104ZF	Capacitor 0.1 μ F	1	D201	MA165	Diode	1
C37	ECFF1E104ZF	Capacitor 0.1 μ F	1	D202	MA165	Diode	1
C38	ECEA1HU3R3	Capacitor 3.3 μ F	1	D203	MA165	Diode	1
C39	ECFF1E104ZF	Capacitor 0.1 μ F	1	D204	MA165	Diode	1
C40	ECFF1E104ZF	Capacitor 0.1 μ F	1	D205	MA165	Diode	1
C41	ECFF1E104ZF	Capacitor 0.1 μ F	1				
C42	ECFF1E104ZF	Capacitor 0.1 μ F	1	X201	DECA08867H1M	Crystal	1
C44	ECQV1H222JZ	Capacitor 0.0022 μ F	1				
C45	ECQV1H104JZ	Capacitor 0.1 μ F	1	L201	ELEMY390KA	Coil	1
C46	ECFF1E104ZF	Capacitor 0.1 μ F	1	L202	ELEMY390KA	Coil	1
C47	ECFF1E104ZF	Capacitor 0.1 μ F	1	L203	ELEMY390KA	Coil	1
C48	ECCD1H330KC	Capacitor 33 pF	1	L204	ELEMY390KA	Coil	1
C49	ECFF1E104ZF	Capacitor 0.1 μ F	1				
C50	ECFF1E104ZF	Capacitor 0.1 μ F	1	R201	ERDS2TJ564	Resistor 560K ohms	1
C51	ECFF1E104ZF	Capacitor 0.1 μ F	1	R202	ERDS2TJ562	Resistor 5.6K ohms	1
C52	ECSF1AE225	Capacitor 22 μ F	1	R203	ERDS2TJ101	Resistor 100 ohms	1
C53	ECFF1E104ZF	Capacitor 0.1 μ F	1	R204	ERDS2TJ102	Resistor 1K ohms	1
C54	ECFF1E104ZF	Capacitor 0.1 μ F	1	R205	ERDS2TJ393	Resistor 39K ohms	1
C55	ECSF1AE225	Capacitor 22 μ F	1	R206	ERDS2TJ822	Resistor 8.2K ohms	1
C56	ECFF1E104ZF	Capacitor 0.1 μ F	1	R207	ERDS2TJ122	Resistor 1.2K ohms	1
C57	ECFF1E104ZF	Capacitor 0.1 μ F	1	R208	ERDS2TJ561	Resistor 560 ohms	1
C58	ECFF1E104ZF	Capacitor 0.1 μ F	1	R209	ERDS2TJ102	Resistor 1K ohms	1
C59	ECFF1E104ZF	Capacitor 0.1 μ F	1	R210	ERDS2TJ822	Resistor 8.2K ohms	1
C60	ECFF1E104ZF	Capacitor 0.1 μ F	1	R211	ERDS2TJ102	Resistor 1K ohms	1
C61	ECFF1E104ZF	Capacitor 0.1 μ F	1	R212	ERDS2TJ822	Resistor 8.2K ohms	1
C62	ECFF1E104ZF	Capacitor 0.1 μ F	1	R213	ERDS2TJ105	Resistor 1M ohms	1
C63	ECFF1E104ZF	Capacitor 0.1 μ F	1	R215	ERDS2TJ103	Resistor 10K ohms	1
C64	ECEA1CU100	Capacitor 10 μ F	1	R216	ERDS2TJ393	Resistor 39K ohms	1
C65	ECFF1E104ZF	Capacitor 0.1 μ F	1	R217	ERDS2TJ103	Resistor 10K ohms	1
C66	ECFF1E104ZF	Capacitor 0.1 μ F	1	R218	ERDS2TJ104	Resistor 100K ohms	1
C67	ECFF1E104ZF	Capacitor 0.1 μ F	1	R219	ERD25TJ271	Resistor 270 ohms	1
C68	ECCF1H680JC	Capacitor 68 pF	1	R220	ERDS2TJ102	Resistor 1K ohms	1
C69	ECFF1E104ZF	Capacitor 0.1 μ F	1	R221	ERDS2TJ123	Resistor 12K ohms	1
C70	ECGF1H151JC	Capacitor 150 pF	1	R222	ERDS2TJ103	Resistor 10K ohms	1
C71	ECEA1AU101	Capacitor 100 μ F	1	R223	ERDS2TJ102	Resistor 1K ohms	1
C72	ECEA1AU101	Capacitor 100 μ F	1	R224	ERDS2TJ471	Resistor 47 ohms	1
C73	ECEA1AU101	Capacitor 100 μ F	1	R225	ERDS2TJ151	Resistor 150 ohms	1
C74	ECEA1AU101	Capacitor 100 μ F	1	R226	ERD25TJ221	Resistor 220 ohms	1
C75	ECFF1E104ZF	Capacitor 0.1 μ F	1	R227	ERDS2TJ680	Resistor 68 ohms	1
C76	ECFF1E104ZF	Capacitor 0.1 μ F	1	R229	ERDS2TJ102	Resistor 1K ohms	1
C77	ECFF1E104ZF	Capacitor 0.1 μ F	1	R230	ERDS2TJ102	Resistor 1K ohms	1
C78	ECFF1E104ZF	Capacitor 0.1 μ F	1	R231	ERDS2TJ221	Resistor 220 ohms	1
C79	ECFF1E104ZF	Capacitor 0.1 μ F	1	R232	ERD25TJ101	Resistor 100 ohms	1
C80	ECFF1E104ZF	Capacitor 0.1 μ F	1	R233	ERD25TJ102	Resistor 1K ohms	1
C81	ECFF1E104ZF	Capacitor 0.1 μ F	1	R234	ERD25TJ272	Resistor 2.7K ohms	1
C82	ECFF1E104ZF	Capacitor 0.1 μ F	1	R235	ERD25TJ473	Resistor 47K ohms	1
C83	ECEA1CU472	Capacitor 4700 μ F	1				
E1	DFJP5G1Z	Connector, CN1	1	CT201	ECRH020D11	Trimmer	1
E2	DFJS9H1Z	Connector, CN2	1				
E3	DFJS08J01Z	Connector, CN3	1	C201	ECEA1CU100	Capacitor 10 μ F	1
E4	FBM-403-075	Connector, CN4	1	C202	ECEA1CU100	Capacitor 10 μ F	1
E5	DFJS3H1Z	Connector, CN5	1	C203	ECEA1HUR47	Capacitor 0.47 μ F	1
E6	EMCAD05001A1	Connector, CN6, CN7	2	C204	ECQV1H103JZ	Capacitor 0.01 μ F	1
E7	DFJS15H1Z	Connector, CN8	1	C205	ECEA1CU100	Capacitor 10 μ F	1
E8	DFJS8H1Z	Connector, CN9	1	C206	ECEA1AU470	Capacitor 47 μ F	1
E9	FBM-403-052	Connector, PT1, PT2	2	C207	ECEA1AU470	Capacitor 47 μ F	1
E10	DFUS0001Z	Spring	1	C208	ECEA1CU100	Capacitor 10 μ F	1
E11	FBM-415-010	Fuse Holder	2	C209	ECQV1H103JZ	Capacitor 0.01 μ F	1
E12	XBAD31501	Fuse	1	C210	ECEA1HUR47	Capacitor 0.47 μ F	1
E13	DFMC0005Z	Shield Case, VDP	1	C211	ECCD1H220KC	Capacitor 22 pF	1
E14	DFMY0005Z	Heat Sink	1	C212	ECCD1H100KC	Capacitor 10 pF	1
E15	DFMC0009Z	Cover, Shield Case	1	C213	ECCD1H270KC	Capacitor 27 pF	1
E16	XSN3+12S	Screw	4	C214	ECCD1H330KC	Capacitor 33 pF	1
E17	XWA3B	Washer	6	C215	ECEA1CU100	Capacitor 10 μ F	1
E18	XNG3ES	Nut	4	C216	ECCF1H330KC	Capacitor 33 pF	1
E19	XSN3+10S	Screw	2	C217	ECEA1CU100	Capacitor 10 μ F	1
E20	XWG3	Washer	2	C218	ECEA1CU471	Capacitor 470 μ F	1
E21	DDB6M001L-F	Ferrite bead	9	C219	ECFF1E104ZF	Capacitor 0.1 μ F	1
VIDEO P.C.Board Block				C220	ECEA0JU102	Capacitor 1000 μ F	1
IC201	RVITC40H004P	IC, OSCILLATOR	1	C221	ECFF1E104ZF	Capacitor 0.1 μ F	1
IC202	AN2430	IC, ENCODER	1	C222	ECCD1H020KC	Capacitor 2 pF	1
IC203	DN74LS74A	IC, FREQUENCY DIVIDER	1	C223	ECCF1H330KC	Capacitor 33 pF	1
IC204	DN74LS74A	IC, FREQUENCY DIVIDER	1	C224	ECEA1AU101	Capacitor 100 μ F	1
IC205	DN74LS86	IC, QUADRUPLE OR GATES	1	C225	ECEA1CU100	Capacitor 10 μ F	1
Q201	2SB641Q	Transistor	1	C226	ECFF1E104ZF	Capacitor 0.1 μ F	1
Q202	2SC2647B	Transistor	1				
				E22	DFJE002Z	Flat Cable	1
				E23	DFUL0005Z	Reinforcement Board	1
				E24	DFMC0006Z	Shield Plate	1

Ref. No.	Part No.	Part Name & Description	Per Set
E25	DFJF1A001Z	Pin Jack, VIDEO	1
E26	DFJF1A002Z	Pin Jack, SOUND	1
E27	DFSD002Z	RF Modulator	1
Power Source Block			
T101	DDT5M7E01Z	Transformer	1
L101	DDASC0210V	Coil	1
SW101	EST15802B	Power Switch	1
C101	ECQE2A104M	Capacitor 0.1 µF	1
C102	ECQE2A104M	Capacitor 0.1 µF	1
E28	DFJP02G1Z	Connector, CN101	1
E29	DFJP02G2Z	Connector, CN102	1
E30	DFJA03Z	AC Cord	1
E31	DFJS2G1Z	Connector	1
E32	DFJT401Z	Contact	2
E33	DFUV0003Z	Switch Cap	1
E34	RHR993Z	Band	1
E35	DFMD003Z	Attachment stand	1
E36	DFJP02G2Z	Fuse Holder	2
E37	XBAD01601	Fuse	1
E38	XTV3+8BFN	Screw	2
E39	XTN3+8B	Screw	4
E40	XWG3	Washer	4
Keyboard Block			
D301	LN220RP	LED, Power	1
D302	LN88RCPP	LED,	1
1	DFWV70C0001	Key Button F1	1
2	DFWV70C0002	Key Button F2	1
3	DFWV70C0003	Key Button F3	1
4	DFWV70C0004	Key Button F4	1
5	DFWV70C0005	Key Button F5	1
6	DFWV70C0006	Key Button F6	1
7	DFWV70C0007	Key Button F7	1
8	DFWV70C0008	Key Button F8	1
9	DFWV70C0009	Key Button F9	1
10	DFWV70C0010	Key Button F10	1
11	DFWV70C0011	Key Button F11	1
12	DFWV70C0012	Key Button F12	1
13	DFWV70C0013	Key Button F13	1
14	DFWV70C0014	Key Button F14	1
15	DFWV70C0015	Key Button F15	1
16	DFWV70C0016	Key Button F16	1
17	DFWV70C0017	Key Button F17	1
18	DFWV70C0018	Key Button F18	1
19	DFWV70C0019	Key Button F19	1
20	DFWV70C0020	Key Button F20	1
21	DFWV70C0021	Key Button F21	1
22	DFWV70C0022	Key Button F22	1
23	DFWV70C0023	Key Button F23	1
24	DFWV70C0024	Key Button F24	1
25	DFWV70C0025	Key Button F25	1
26	DFWV70C0026	Key Button F26	1
27	DFWV70C0027	Key Button F27	1
28	DFWV70C0028	Key Button F28	1
29	DFWV70C0029	Key Button F29	1
30	DFWV70C0030	Key Button F30	1
31	DFWV70C0031	Key Button F31	1
32	DFWV70C0032	Key Button F32	1
33	DFWV70C0033	Key Button F33	1
34	DFWV70C0034	Key Button F34	1
35	DFWV70C0035	Key Button F35	1
36	DFWV70C0036	Key Button F36	1
37	DFWV70C0037	Key Button F37	1
38	DFWV70C0038	Key Button F38	1
39	DFWV70C0039	Key Button F39	1
40	DFWV70C0040	Key Button F40	1
41	DFWV70C0041	Key Button F41	1
42	DFWV70C0042	Key Button F42	1
43	DFWV70C0043	Key Button F43	1
44	DFWV70C0044	Key Button F44	1
45	DFWV70C0045	Key Button F45	1
46	DFWV70C0046	Key Button F46	1
47	DFWV70C0047	Key Button F47	1
48	DFWV70C0048	Key Button F48	1
49	DFWV70C0049	Key Button F49	1
50	DFWV70C0050	Key Button F50	1
51	DFWV70C0051	Key Button F51	1
52	DFWV70C0052	Key Button F52	1
53	DFWV70C0053	Key Button F53	1
54	DFWV70C0054	Key Button F54	1
55	DFWV70C0055	Key Button F55	1
56	DFWV70C0056	Key Button F56	1
57	DFWV70C0057	Key Button F57	1
58	DFWV70C0058	Key Button F58	1
59	DFWV70C0059	Key Button F59	1
60	DFWV70C0060	Key Button F60	1
61	DFWV70C0061	Key Button F61	1
62	DFWV70C0062	Key Button F62	1
63	DFWV70C0063	Key Button F63	1
64	DFWV70C0064	Key Button F64	1
65	DFWV70C0065	Key Button F65	1
66	DFWV70C0066	Key Button F66	1
67	DFWV70C0067	Key Button F67	1
68	DFWV70C0068	Key Button F68	1
69	DFWV70C0069	Key Button F69	1
70	DFWV70C0070	Key Button F70	1
71	DFWV70C0071	Key Button F71	1
72	DFWV70C0072	Key Button F72	1
73	DFWV70C0073	Key Button F73	1
E41	DFWV48A0008	Flexible Pattern Ass'y	1
E42	FBM-652-K20	Switch Unit A, B, C etc.	55
E43	FBM-652-K21	Switch Unit CURSOR	4
E44	FBM-652-K23	Switch Unit SPACE	1
E45	FBM-652-K24	Switch Unit	1
E46	FBM-652-K26	Switch Unit (left side)	1
E47	FBM-652-K25	Switch Unit	1
E48	FBM-652-K22	Switch Unit FUNCTION	10
E49	FBM-652-K22	Switch Unit SPACE (both ends)	2
E50	FBM-717-023	Arm, SPACE	1
E51	FBM-717-022	Arm,	2
E52	FBM-652-146	Installation Board, SPACE	2
E53	FBM-653-034	LED Contact	2
E54	DFWV65C0005	LED Holder	2
Cabinet Block			
K1	DFKE0002Z	Slot Cover	2
K2	FBM-728-011	Slot Spring	2
K3	DFKM0004Z	Upper Cabinet	1
K4	DFGP0002Z	Slot Pannel	1
K5	FBM-438-008	Micro Switch	2
K6	DFMD0001Z	Pressure Board	1
K7	DFDF3001Z	Support Shaft	1
K8	FBM-845-033	Connector Cover, CN4	1
K9	DFUV0004Z	Connector Cover, PT1, PT2	1
K10	DFWV80C0006	Bottom Cabinet Ass'y	1
K11	DFMC0004Z	RF Shield Plate	1
K12	DFMC0003Z	Bottom Shield Plate	1
K13	DFMY003Z	Heat Sink	1
K16	XTN3+10B	Screw	14
K17	XWG3	Washer	15
K18	XTV3+16BFZ	Screw	3
K19	XTN3+8BFN	Screw	2
K20	XTN3+6B	Screw	1
K21	XTN3+6S	Screw	2
K22	XWA3B	Spring Washer	2
Accessories			
K23	DFJP00201Z	Cable, CASSETTE	1
K24	FBM-497-022	Cable, SOUND	1
K25	DFJP0E01Z	Cable, RF	1
K26	DFJP0E02Z	Cable, VIDEO	1
K27	DFPK0021Z	Packing Case	1
K28	DFPP0001Z	Wrap, Set	1
K29	DFQA1702Z	Graphic Labels	1
K30	DFPN0001Z	Insulation Material, Right Side	1
K31	DFPN0002Z	Insulation Material, Left Side	1
K32	QPC0072	AC Cord Cover	1
K33	DFQX2004Z	BASIC Manual	1
K34	DFQX5003Z	Instruction Manual	1